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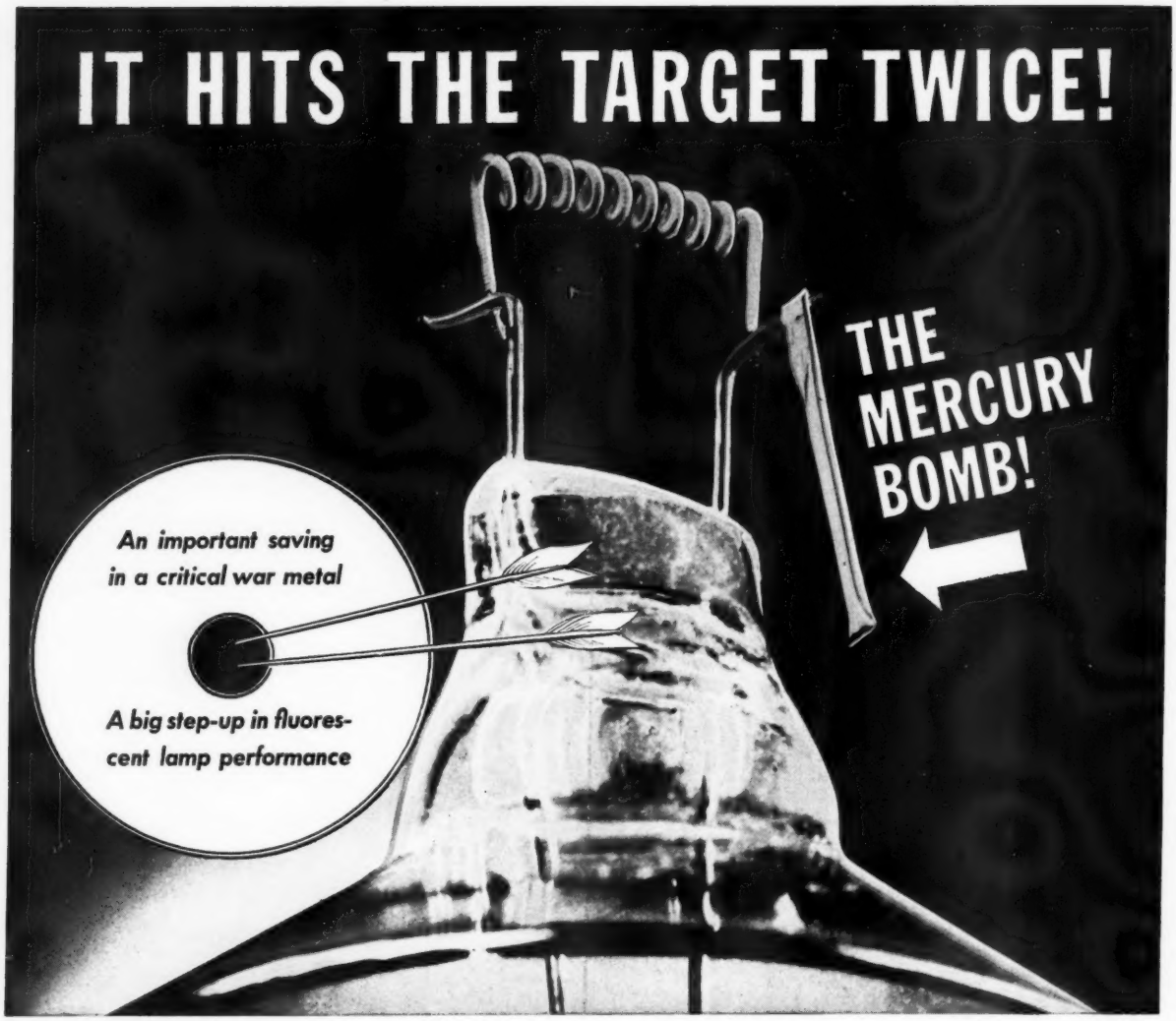

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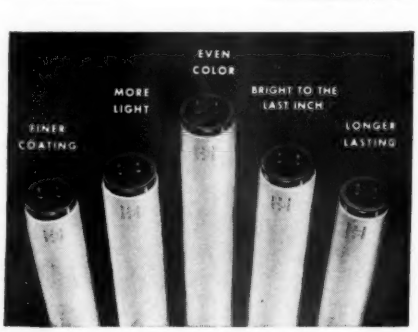

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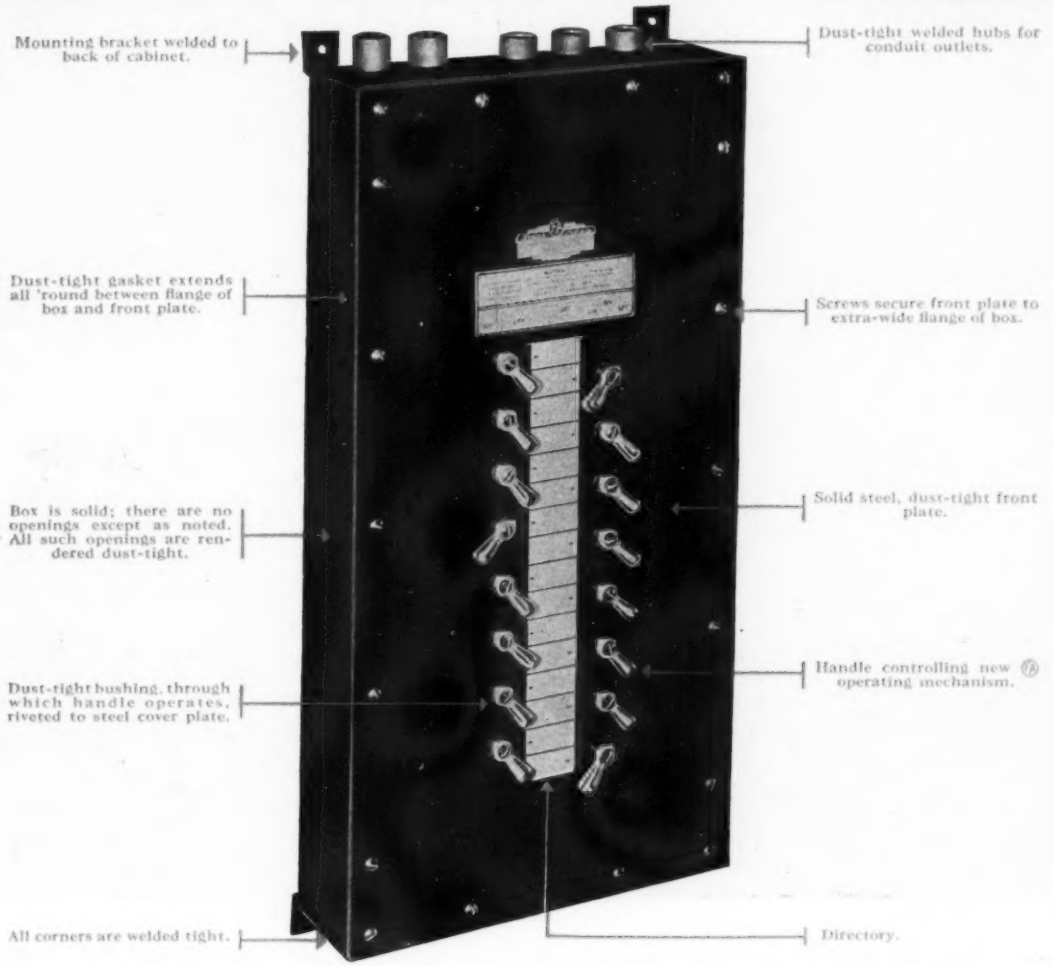
for safety in dust-laden atmospheres


Mounting bracket welded to back of cabinet.
Dust-tight welded hubs for conduit outlets.
Dust-tight gasket extends all 'round between flange of box and front plate.
Screws secure front plate to extra-wide flange of box.
Box is solid; there are no openings except as noted. All such openings are rendered dust-tight.
Solid steel, dust-tight front plate.
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All corners are welded tight.
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This panelboard is especially designed for use in shell loading plants, coal mines, coal storage rooms, flour mills and other places where dust is a hazard. It is approved by Underwriters' Laboratories, Inc., for "Class II, Groups F and G, Hazardous Locations," covering atmospheres containing carbon black, coal or coke dust and grain dust.

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Volume 22 Number 8

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AUGUST, 1942

ELECTRICAL SOUTH

Volume 22 No. 8

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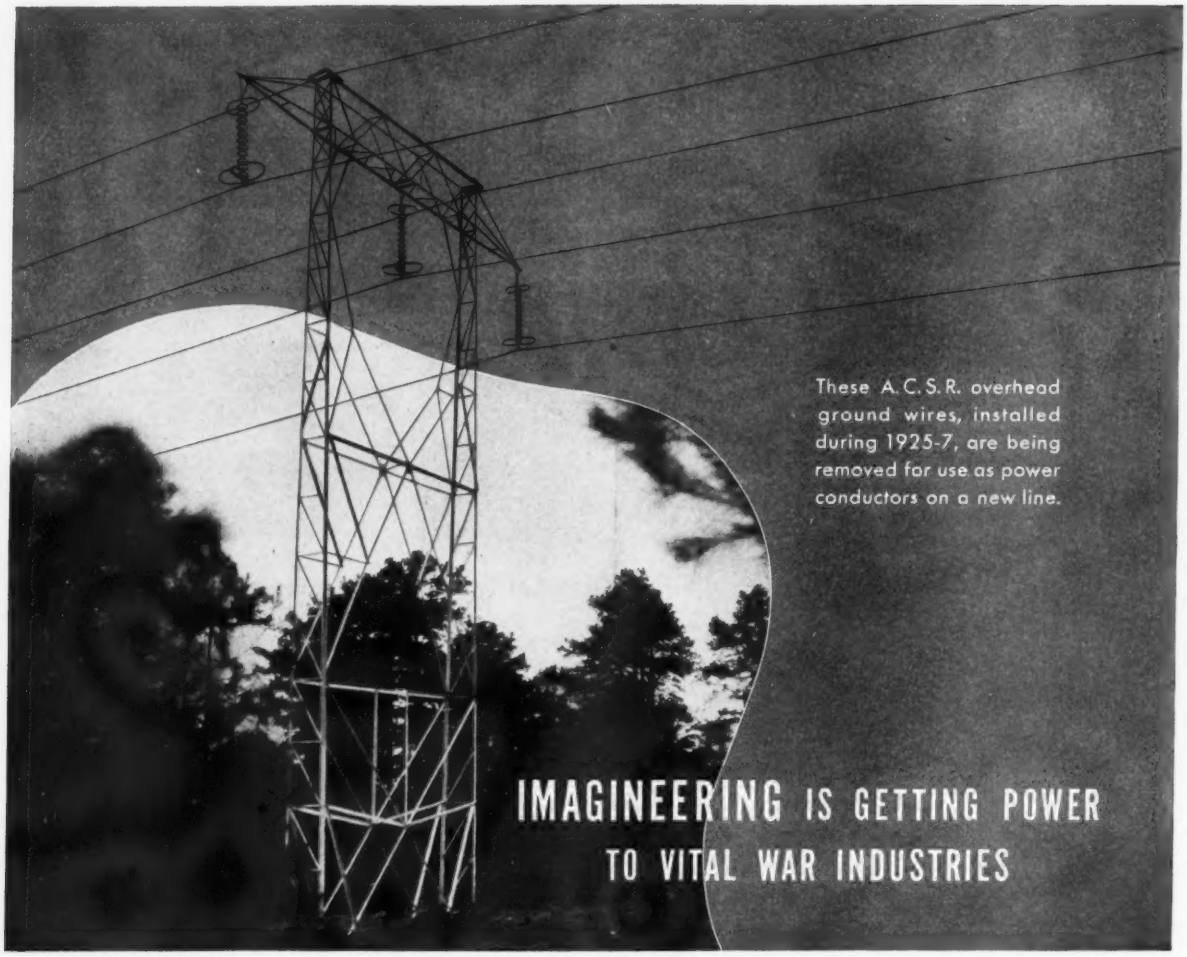
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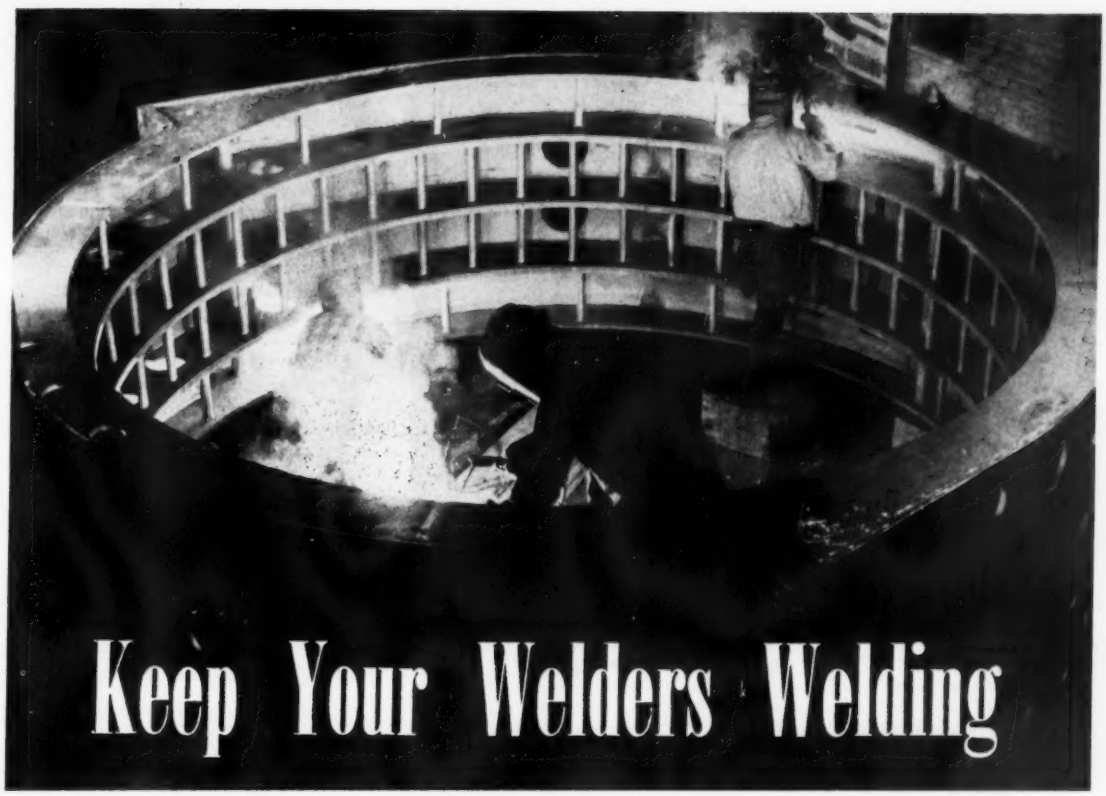


Keep Your Welders Welding

By R. F. Wyer*

WHILE arc welding sets today represent the highest in simplicity and reliability, they require attention from a maintenance standpoint if they are to be kept in the best operating condition.

With the accent on production in shipyards, ordnance plants, and welding shops of all types, the failure of even a few sets is sometimes costly. A systematized maintenance program will pay dividends in terms of better welder performance and longer life.

Selection and Installation

The right welding set must be selected for the job, because a maintenance program will be discouragingly difficult if misfit equipment is being used.

To insure proper choice of the rating of a single-operator set, the maximum current, load voltage, and duty factor (ratio of arc time to total time) must be taken into account. Except in the smallest sizes, most sets are rated on a one-hour load. Their rating is the current which they will deliver for one hour without interruption, without exceeding a prescribed temperature rise.

Since this method of rating, chosen as a simple standard for comparison, does not take into account actual operating conditions, it is not always economically sound to choose the size next larger than the maximum operating current contemplated. However, for this same reason duty factor should be taken into account when new equipment is being considered to make certain that the set is big enough for the job.

Proper installation can do much to keep the welding equipment at work and troubles to a minimum. In wiring up a welding set, care should be taken to provide adequate branch circuit conductors, and fuse clips large enough to accommodate the necessary fuses. It should be observed that motor-generator type welding equipments have full-voltage motor starters almost without exception, so that due consideration must be given to the starting current of the motors.

Care should be taken to ground the frames of all welding equipment in order to avoid shock or annoying tickles when a grounded person touches the frame of the equipment. Even with equipment in perfect operating condition, under some conditions, it is possible to receive a harmless but irritating sensation of shock from ungrounded equipment due to the passage of infinitesimal capacity or leakage currents. In addition to protecting against this annoyance, adequate grounding of machine frames is also a desirable safety precaution against harm resulting from insulation failure in equipment or leads, or improper connections.

Grounding Precautions

Regardless of the type of safety ground connection which is installed, adequate low resistance work leads should always be used, and care should be taken to secure good connection between the work lead and the work. If this is not done, it is possible under some circumstances to overheat the safety ground connection by the passage of welding current through it.

In the location of welding equipment, ventilation is a very im-

*Mr. Wyer is welding engineer for General Electric Company, Schenectady, N. Y.

Sanding brushes to a good fit with the commutator is essential whenever new brushes are installed. This operation is described in detail in the accompanying text on welder maintenance practice.

The blowing of dust out of welder should be done carefully with low-pressure air to avoid driving abrasive dust into insulation. Metallic dust can be most damaging to electrical coils.

portant consideration. The life of electrical insulation is seriously shortened by overheating, and overheating is bound to result where insufficient ventilation is provided. Particularly where large numbers of welding equipments are to be located in small enclosures, considerable study should be given to the problem of supplying clean, cool ventilating air.

Where small houses or temporary sheds are located in hot sunshine, the heat absorbed from the sun added to the heat dissipated by the welding equipments may raise the ambient temperature above 100° F. and cause severe overheating. In such cases, large louvers or other ventilating openings should be provided in the building not only at the bottom but near the roof to give good air circulation and keep the ambient temperature below 100° F. In some instances, it is desirable to provide exhaust fans to assist in removing heated air from the upper part of such enclosures.

Inspection and Regular Servicing

The competent maintenance man will have a record of all welders under his care. One of the most useful and easy-to-handle references is a card file. All repair work, with its cost, can be entered on the record, and any welder requiring excessive attention or expense can be investigated and causes determined and corrected.

Inspection records will also serve as a guide to tell when welders should be replaced because of high cost to keep them in operating condition. Misapplications, abuses, and the like will also be disclosed.

A systematic and periodic inspection of motors and generators is necessary to insure best operation. While some welders are installed where conditions are ideal —where dust, dirt, and moisture are not present to an appreciable degree—most machines are located where some sort of dirt accumulates on the windings. This lowers insulation resistance and cuts down creepage distances.

Steel-mill dusts are usually highly conductive, if not abrasive, and lessen creepage distances. Other dusts are highly abrasive and actually cut the insulation in being carried through by the ventilating air. Fine cast-iron dust quickly penetrates most insulating materials.

Hence the desirability of inspecting motors periodically. If conditions are extremely severe, weekly inspection and partial cleaning are desirable. Most motors require a complete overhauling and thorough cleaning about once a year.

Weekly and Yearly Cleaning

For the weekly cleaning, the motor and generator should be blown out with dry compressed air (about 25 to 30 pounds per square inch in pressure). Where conducting and abrasive dusts are present, even lower pressure may be necessary, and suction is to be preferred, as damage can easily be caused by blowing the dust and metal chips into the insulation. On most motors the windings are fairly accessible, however, and the air can be properly directed to prevent such damage.

About once a year, welders should be overhauled. First, the heavy dirt and grease should be removed with a heavy, stiff brush, wooden or fiber scrapers, and cloths. Rifle-cleaning bristle brushes can be used in air ducts. Dry dust and dirt can be blown off, using dry compressed air at moderate pressure. Care must be taken to direct the air so that the dust will not cause damage and will not be pocketed in the various corners. Grease, oil, and sticky dirt are easily removed by applying cleaning liquids such as carbon tetrachloride.

If the welder can be spared from service long enough, the insulation of the motor should be dried out by heating to from 90° to 100° C. While the motor is still warm, a high-grade insulating varnish should be applied.

The varnish may be sprayed or brushed on. After applying the varnish, the best results are obtained by baking for 6 or 7 hours at about 100° C. If the machine must be put back into service quickly, or if facilities are not available for baking, fairly good results will be obtained by applying one of the varnishes which dry in a few hours at ordinary room temperatures.

Lubrication Instructions

Manufacturers' instructions regarding lubrication of bearings should be carefully noted. These instructions should be kept near the welder so that they are readily accessible. Usually grease-packed bearings have sufficient lubri-

The resistance measuring instruments now available provide a convenient means of determining the condition of the insulation by indicating its resistance to leakage currents.

Hand-operated grease guns should always be used on pressure-relief lubricated bearings. Grease should be added slowly to permit excess to vent from relief pipe or plug. (Latter not visible here.)

cant when shipped from the factory to last about a year under normal conditions of cleanliness and temperature. When sets are operated in unusually dirty atmospheres, run continuously 24 hours per day, or exposed to extremes of temperature, it would be well to shorten the bearing inspection and lubrication interval down to six months, or less if experience warrants.

An occasional check of bearing temperature by feeling with the hand may disclose undue heating before damage is actually done. Once a lubricating routine has been established, it should be carried out, and by reliable men who will follow instructions.

It is pretty generally established that outside of gross neglect for long periods of time, the major causes of bearing troubles are overgreasing and dirt. Overgreasing results in excessive heating of the bearing, frequently with churning and breaking down of the grease with consequent loss of its protective qualities.

Dirt occasionally gets into a bearing through the use of grease that is carried around or stored in uncovered containers. Quite as frequently it gets in through carelessness in protecting parts while bearings are disassembled or opened for inspection.

Only a high grade of grease should be used on ball bearings.

Brushes and Commutators

Brush inspection is important. The first essential requirement for the satisfactory operation of brushes is the free movement of the brushes in their holders. Uniform brush pressure also is necessary to assure equal current distribution. Adjustment of brush holders should be set so that the face of the holder is approximately ⅛" up from the commutator; any distance greater than ⅛" may cause brushes to wedge, resulting in chattering and excessive sparking.

It is essential that the correct grade of brush for a specific application be used. Recommendations as to the correct grade of brush should be obtained from the manufacturer of the welder only.

Broken brushes imply two possibilities: incorrect brush grade, or mechanical defects (such as unbalanced, rough, or eccentric commutator). To eliminate brush breakage, both factors should be corrected.

Maintenance Check Chart for Electrical Welding Apparatus

Machine Fails to Hold Heat

Causes	What To Do
Rough or dirty commutator	Commutator should be trued or cleaned
Brushes may be worn down to limit of adjustment or life	Replace or readjust brushes
Brush springs may have lost adjustment or may be broken	Replace or readjust brush springs
Field circuit may have variable resistance connection or intermittent open circuit	Check field current with ammeter to discover varying current. This applies to both the main generator and exciter if used
Electrode lead or work lead connections may be poor	Tighten all connections
Wrong grade of brushes may have been installed on generators	Check with manufacturer's recommendations
Field rheostat or tap switches may be making poor contact and overheating	Inspect rheostat and clean and adjust finger tension on switches
Brush-shifting or other mechanical current-adjusting mechanism may have loose or worn links	Check current-adjusting mechanism for backlash and play

Welder Starts but Fails to Generate

May be running the wrong way	Check direction of rotation with manufacturer's instructions or direction arrow. On 3-phase motors, direction of rotation may be changed by interchanging any two leads
Generator or exciter brushes may be loose or missing	Be sure that all brushes bear on the commutator and have proper spring tension
Exciter may not be operating	Check exciter output voltage with voltmeter or lamp
Field circuit of generator or exciter may be open	Check for open circuits in rheostat, field leads, and field coils. Also check resistors and rectifiers, if any. Some machines give low output when fields are open
Generator may be reversed in polarity due to another machine or incorrect operation in parallel with another machine	*Flash the field with a storage battery or another generator first with one polarity and then with the other to see if it builds up (Flash exciter field if set has separate exciter)
Series field and armature circuit may be open-circuited	Check circuit with ringer or voltmeter

Check the brushes to make sure that they will not wear down too far before the next inspection. Keep extra sets of brushes available so that replacement can be made when needed. It is false economy to use brushes down to the absolute minimum length before replacement. Cases have been known where brushes have worn down until the metal, where the pigtail connects to the brush, was touching the commutator. This, of course, was causing damage to the commutator.

Make sure that each brush surface, in contact with the commutator, has the polished finish that indicates good contact, and that the polish covers all of the surface of the brush. When replacing a brush be sure to put it in the same brush holder and in its original position. It has been found helpful to scratch a mark on one side of the brush when removing it, so that it will be replaced properly.

New Brush Installation

When installing new brushes, fit them carefully to the commutator. Sand only until the curve of the brushes is the same as that of the commutator. Be sure that the brush shunts (pigtails) are fastened securely so that current will not overheat the brushes and brush holders.

Check the springs that hold the

Machine Fails to Start

Power circuit may be completely dead	Look for open disconnect switch, fuses removed from clips, or blown fuses
Power circuit may be single-phased	Look for one blown fuse or one dead line
Power line voltage may not be suitable for motor, or may be extremely low; may be accompanied by chattering of the motor starter	Check voltage with volt-meter, particularly at the moment of attempted starting
Machine may be jammed	See that armature turns over easily by hand, and look for foreign material in air gaps
Motor starter may be single-phased	Check to see that all fingers on starter make contact when closed
Overlap protecting relays may be tripped	See that relay contacts are closed and that starter picks up when push button is pressed. Be sure to remove cause of tripping

Motor Trips Off Line

Power circuit may be single-phased	Check for one blown fuse or dead line
Welder may be operating above current capacity	Check load against welder nameplate Check duty cycle
Welding electrode or work leads may be too long or too small in cross section	Check terminal voltage while machine is loaded; it should not exceed 30 volts on small machines or 40 volts on large machines when operating at rated current
Ambient temperature may be too high	Make sure that temperature in motor-generator room or housing does not exceed 100 F and that there is no interference with normal ventilation of the machine

Welding Arc is Loud and Spatters Excessively

Current setting may be too high	Check setting and current output with ammeter Check polarity
Polarity may be wrong	Try reversing polarity or try an electrode of the opposite polarity

*"Flashing" the field of a generator or exciter is a method of establishing the residual magnetism of the field structure with the proper polarity to cause the machine to "build-up," or generate voltage. It consists of passing a relatively heavy current through the field windings momentarily, using an external source of direct current to supply the power. If a low-voltage source, such as a storage battery, is used, the series field of the generator should be flashed; if a higher voltage source such as another generator or exciter is used, the shunt field should be flashed.

brushes against the commutator. Improper spring pressure may lead to commutator wear and excessive sparking. Excessive heating may have annealed the springs, in which case they should be replaced and the cause of heating corrected.

Inspect the commutator for color and condition. It should be clean, smooth, and glossy, with a color varying from straw to chocolate brown where the brushes ride on it. A bluish or reddish color indicates overheating of the commutator. Roughness of the commutator should be removed by sandpapering or stoning. Never use emery cloth or an emery stone. Use a "fine" stone or number 00 sandpaper unless the commutator is in bad condition, when the job may be started with a "coarse" stone and finished with "fine."

For this operation, press the stone or sandpaper against the commutator with moderate pressure with the motor running, and move it back and forth across the commutator surface. Use care not to come in contact with live parts. Be sure to keep the dust out of the machine.

If the commutator is very rough as evidenced by pronounced up and down vibration of the brushes, the armature should be taken out and the commutator turned down in a lathe. When this is done, it is usually necessary also to cut back the insulation between the commutator bars slightly. If the commutator is found to be dirty when the generator is inspected, it should be wiped clean with a piece of canvas or other cloth that is free from lint.

Never put oil on the commutator. Proper selection of brushes gives the commutator all the lubrication required to prevent excessive wear and to build up a good smooth operating glazed surface on the copper. The addition of oil results in the development of a high resistance film which may cause undue heating and rough brush action. The oil will also have a detrimental effect on the internal parts of the commutator.

Transformer Maintenance

The arc welding transformers of alternating-current welders require a minimum of maintenance, but this fact should not be allowed to result in neglect. On fan-cooled units, fans should be cleaned and lubricated about once a year. Windings should be blown out at least twice a year in very clean locations, and more often in dusty places. At the time of this periodic attention, all connections and coil supports should be checked for tightness. Manual current adjusting mechanisms should be lubricated often enough to prevent stiff operation of the handwheel or crank, making sure that a fairly high melting-point grease is uniformly distributed over the full length of screws and guides.

On motor-operated controls, lubrication at more frequent intervals may be required, as evidenced by slowing down of the motor or noise from the gearing. This point should be checked at least three times a year, and more often if experience justifies it.

Abuses of Equipment

While most welding equipment is designed to stand up under unusually adverse operating conditions, some not infrequent circumstances will cause serious impairment if not complete interruptions of their service.

One bad practice, for example, is that of leaving weather-protecting tarpaulins thrown over machines in operation, in such a way as to interfere with the free passage of ventilating air into and out of the equipment. Cases are known where welders have been equipped with canvas flaps perm-

(*Continued on page 54*)

PLANNING FOR INDUSTRIAL

Lighting Maintenance

By W. H. Kahler*

This is the second of a series of three articles on the servicing of industrial lighting equipment. In this article, Mr. Kahler tells how to plan a regular cleaning and lamping schedule.

●

FIFTEEN footcandles or 30 footcandles; which would you take if the cost was the same for either? Naturally, you will answer 30 footcandles, but how, you will ask, can I get 30 footcandles for the same cost as 15 footcandles. The answer is briefly explained by the following example.

Not long ago the author was called upon to survey the lighting in a large plant where the workers were complaining of poor seeing conditions. It was found that the average illumination was about 15 footcandles and in some locations was as low as 5 footcandles. However, when the lighting equipment had been installed a few years before, the average illumination was 30 footcandles. It was soon learned that this drop in illumination was an accumulation of three causes:

1. **Lamp outages**
2. **Dirty luminaires**
3. **Lamps of improper voltage rating.**

By thorough cleaning and proper lamping, the original 30 footcandles was obtained.

Recent surveys indicate that 40 to 60 per cent depreciation of the initial illumination is also common in many other plants. The main reason for such high depreciation is due entirely to neglected maintenance. Dirty luminaires, lamp outages, improper voltage, and dirty walls and ceilings, are all enemies of adequate lighting.

These high depreciation factors which cause poor, inadequate illumination may actually be very costly to the owners because the workers are deprived of the use of the illumination for which the lighting system was designed. Therefore, they must work under lower lighting levels which hinder the speed and accuracy of seeing and thus reduce the rate of production.

Also, if only half the designed footcandles are received on the working plane, the cost per footcandle is about doubled. If a lighting system is designed to include allowance for neglected maintenance, a high depreciation factor will be used and many more luminaires will be required, thus increasing the initial and operating cost.

Consider for example a building of 10,000 sq. ft. To provide 30 footcandles in service with an allowance of 25 per cent for depreciation, sixty 500-watt units would be required. If, however, the architect allowed 50 per cent for depreciation because of anticipated poor maintenance, ninety 500-watt units would be necessary. This represents an increase of 50 per cent in the initial and operating cost because 50 per cent more units are necessary to compensate for poor maintenance. In dollars and cents, this would mean an additional annual operating cost of about $800 for an average plant using its lighting about 4,000 hours per year. Certainly, the 60 units could be properly and regularly maintained for a small fraction of $800.

Of course, the architect does not have control of the building maintenance, so it is the owner's responsibility to set up a maintenance schedule that is practical and that will enable the lighting system to provide the actually designed footcandle values in service.

Individual Responsibility

A number of plants realizing the importance of maintenance have set up regular schedules for serv-

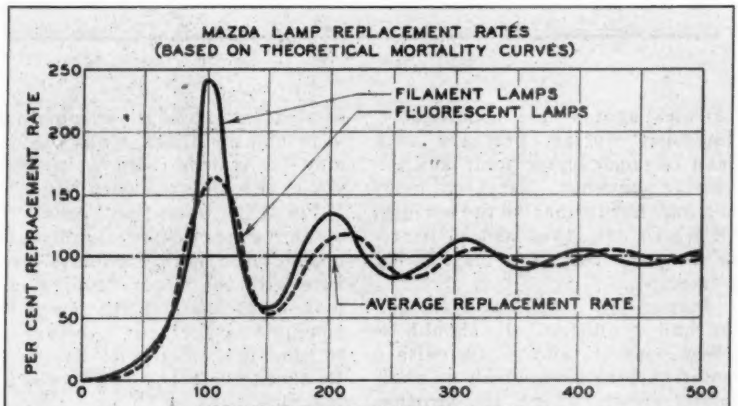


Fig. 1. This Mazda lamp replacement rate curve will be of value in estimating the probable number of lamp replacements per month for a new installation. Note that few replacements will be required for the first few hundred hours and that this rate increases and reaches a peak at 100 per cent of average lamp life. Eventually the rate levels off to the normal calculated value.

*Mr. Kahler is lighting engineer for the Westinghouse Lighting Divison, Edgewater Park, Cleveland, Ohio.

icing the lighting and they find that such schedules are relatively inexpensive to keep up after a systematic scheme is worked out.

First, it is important that complete responsibility for taking care of the lighting system be given to one supervisor. In some plants, lighting has been a responsibility of each department head and he naturally considers lighting a secondary item because his main job is to get out production, not to relamp and clean fixtures. As a result, lighting is neglected. Where all lighting is under the responsibility of one man, a lighting maintenance crew can be trained to do cleaning and relamping on a regular predetermined schedule for the entire plant.

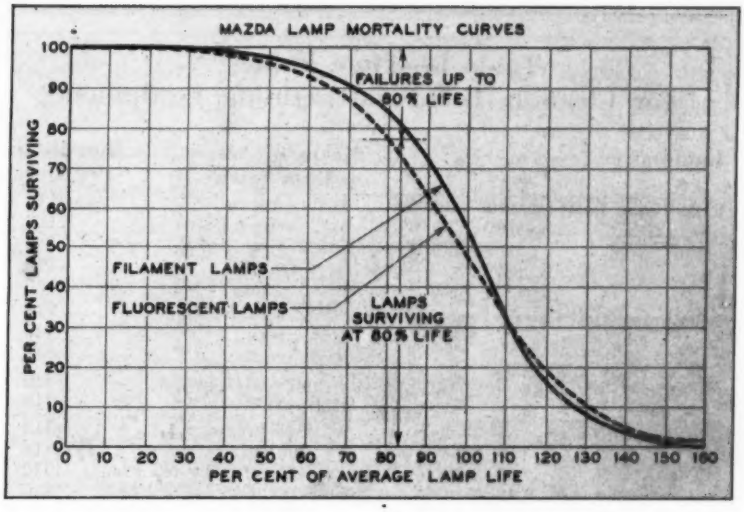

MAZDA LAMP MORTALITY CURVES
PER CENT LAMPS SURVIVING
FAILURES UP TO 80% LIFE
FILAMENT LAMPS
FLUORESCENT LAMPS
LAMPS SURVIVING AT 80% LIFE
PER CENT OF AVERAGE LAMP LIFE

Fig. 2. Mazda lamp mortality curves. These curves indicate the percentage of lamps that will be burning at the end of any given period measured in per cent of average lamp life. It is especially useful in planning group replacements.

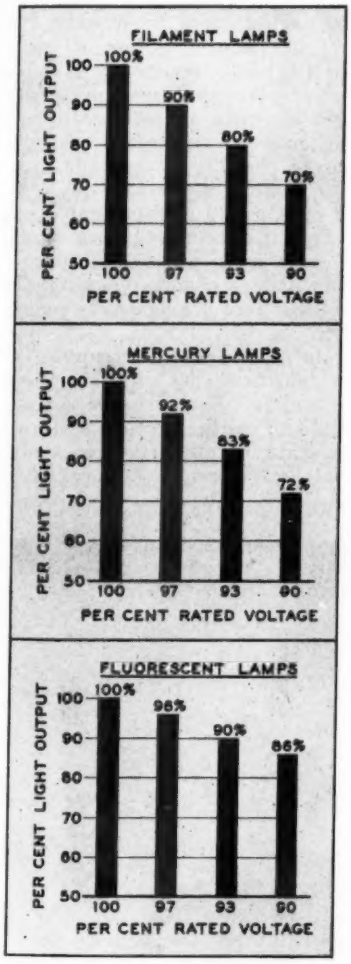


Fig. 3. A few per cent drop in voltage will cause a considerable drop in light output. The reduction in light output is most pronounced in the case of filament and mercury lamps but is considerable also for fluorescent lamps. These charts show per cent of rated light output at 100, 97, 93 and 90 per cent of rated voltage.

There are five fundamental requirements to a well planned maintenance schedule:

1. Provide easy access to all luminaires.
2. Clean luminaires regularly.
3. Replace lamp outages promptly.
4. Paint walls and ceiling light colors and keep them light.
5. Maintain rated voltage at luminaires.

Providing Easy Access—This is an obvious requirement which needs little explanation. Details as to how easy access can be provided in industrial plants were given in the first article of this series published in the July issue.

Cleaning Schedule—To establish a well organized cleaning schedule, the lighting supervisor should first obtain a complete inventory of the number, type and wattage of luminaires in each department. This information will enable him to estimate the approximate time required to clean the lights in each department. Table I gives the time values that were established by one large manufacturer for cleaning common types of luminaires. Although these are accurate values for one particular plant, they should only be used for estimating in other plants because time values will vary somewhat due to different labor methods and different types of lighting equipment.

Next, the approximate frequency of cleaning should be determined. To do this, make periodic footcandle tests until the illumination has dropped 15 to 20 per cent. The time elapse for the 15 to 20 per approximate length of time between cleaning. From this information, the lighting supervisor can determine just how often it will be necessary to clean the lighting in various departments. Cleaning every 2, 3, 4, or 6 months works conveniently into a complete 12 month schedule.

If the installation is new and is being checked for rate of depreciation for the first time, allow for an additional 10 to 12 per cent drop in illumination for lamp depreciation.

Table II illustrates a typical schedule such as could be set up for an industrial plant. Note that some departments are cleaned oftener than others because the rate of depreciation was found to be higher in certain locations.

Methods of Cleaning—Lighting fixtures should be washed, not just wiped off with a dry cloth. Dry wiping only removes part of the dirt and may damage the reflector because gritty dirt may scratch the surface. Tests have shown that 10 to 15 per cent more efficiency can be obtained when reflectors are thoroughly washed than when they are just dry wiped.

Porcelain enameled or baked

Table I—Time Values** for Cleaning Industrial Lighting Equipment

Luminaire	Means of Access to Luminaire	Man Hours Per Unit*
RLM Dome Reflecor 100- 200 Watt	6′ step ladder	.115
" 100- 200 Watt	8-12′ step ladder	.125
" 100- 200 Watt	18-22′ step ladder	.136
" 750-1500 Watt	Low cranes	.250
" 750-1500 Watt	High cranes	.263
Aluminum High Bay Reflector	26′ extension ladder	.350
"	Low crane	.330
"	High crane	.345
Mirrored Glass High Bay Reflector	26′ extension ladder	.380
"	High crane	.340
Glassteel Diffuser 150- 200 Watt	8-12′ step ladder	.312
" 150- 200 Watt	18′ ladder	.312
" 150- 200 Watt	18′ ladder congested area	.312
" 150- 200 Watt	Step ladder in office bldg.	.275
" 300- 500 Watt	"	.275
" 300- 500 Watt	18′ ladder—congested area	.330
" 750-1000 Watt	Step ladder in office bldg.	.275
" 750-1000 Watt	18′ ladder—congested area	.450
Mercury-Inc. Combination Unit	Extension ladder	.500
Inc. Enclosing Globe 100-150 Watt	12′ step ladder	.165
" 200-300 Watt	12′ step ladder	.190
Incandescent Indirect 500 Watt	8-12′ step ladder	.235
+RLM Fluorescent 2 lamp, 40 Watt	6′ step lad., 10′ m'nting ht.	.120
+RLM Fluorescent 2 lamp, 40 Watt	12′ step lad., 14′ mnting ht.	.160
"	12′ step ladder	.420
Fluor. Glass Encl., 2 lamp, 40 Watt	8′ step ladder in offices	.480

+Reflector wiped off only, all other items thoroughly cleaned.
* Using a two-man crew.
** Taken from time studies made at the East Pittsburgh Works, Westinghouse Electric & Manufacturing Company.

enamel finishes or glassware should be cleaned with a mild soap and warm water and rinsed with clean warm water. Aluminum reflectors should be cleaned in a similar manner, but avoid the use of strong alkaline or acid cleaning agents. If encrusted dirt is allowed to accumulate on luminaire, clean with Dreft and pumice, Bon Ami, fine steel wool and soap, or liquid wax emulsion.

Relamping—There are two methods of relamping: (1) individual replacement and, (2) group replacement. The first is more practical where luminaires are easy to reach and the labor cost of individual relamping is low.

To minimize footcandle drop due to lamp outages, the buildings should be continually patrolled so that each area is covered every few days by the "lamp changers." If a patrol system is not used, lamp replacements may be neglected and illumination can drop 20 to 30 per cent in a short time.

With very large installations, the number of replacements required per month, or the replacement rate, should be estimated when the maintenance program is planned so that sufficient help and lamps are available. The average number of replacements per month may be computed by multiplying the number of lamps by the average operating hours per month and dividing this product by the rated lamp life. The rated lamp life may be obtained from standard price schedules published by manufacturers.

However, with the first group of lamps in a new installation, there will be relatively few replacements for the first few hundred hours, but the rate will gradually increase until at 100 per cent life, the replacements will be almost twice the normal rate. This is shown by the Replacement Rate Curve, Figure 1. Also, at 200 per cent life, the replacement rate is about 20 or 30 per cent above normal. After the second set of lamps have been replaced, the rate levels off to the normal calculated value.

Where the luminaires are in hard-to-reach locations and special facilities are required for access, a group replacement plan may prove to be more satisfactory than individual replacements. With this plan, the complete set of lamps are replaced when they have burned 70 or 80 per cent of their rated life. A few lamps will, of course, fail before the 70 or 80 per cent time as shown by Figure 2, but these can be replaced at relatively low cost because only a few lamps will be involved.

For example, if group replacement is made at 80 per cent life on a fluorescent installation, there would have been only 20 per cent failures before 80 per cent life was reached. If the group replacement was made at 70 per cent life, there would have been only 10 per cent failures prior to the 70 per cent date.

The actual mechanics of setting-up a group replacement plan involves a careful study of each individual case by a lighting engineer and detailed explanation of this procedure is beyond the scope of this paper.

Painting Versus Footcandles—The fourth enemy of high footcandles is dirty surroundings. Walls and ceilings reflect and absorb light in proportion to their reflection factors. Therefore, with

Fig. 4. Luminaires with removable reflectors facilitate thorough cleaning on the floor at minimum cost. Note the difference between the clean and unclean portion of the reflector surface.

Table II—Cleaning Schedule for a Typical Manufacturing Plant

January	February	March	April	May	June	July	August	September	October	November	December
General Office				General Office				General Office			
	Machine Shop		Assembly Section		Machine Shop		Assembly Section		Machine Shop		Assembly Section
		Warehouse Shipping						Warehouse Shipping			
Foundry			Foundry			Foundry			Foundry		
		Power House				Power House				Power House	
	Chemical Dept.		Yard Lighting	Chemical Dept.			Yard Lighting Chemical Dept.			Chemical Dept.	Yard Lights

high reflectivity surfaces, maximum light will be reflected which will contribute toward increasing the general illumination level. For example, in a room 20 feet wide equipped with 300-watt industrial diffusers at 12-foot mounting height, the illumination will be about 23 per cent higher with light walls than with dark walls. High reflectivity of walls is particularly effective in increasing the illumination along the wall which is necessary to fully utilize all work space.

Light surroundings are helpful in reducing the harsh contrast between bright light sources and their backgrounds, thus minimizing direct glare. Also light walls will increase the diffusion of light which tends to minimize shadows.

Fig. 5. Lamps as well as reflectors must be thoroughly cleaned with soap and water.

Most new plants are now finished properly, but often it is forgotten that surfaces get dirty and reflectivity drops. Therefore, it is important to clean or repaint regularly *to maintain* the original illumination and comfortable seeing conditions.

Voltage Regulation—The fifth factor in controlling the lighting maintenance is to be certain of proper voltage at the luminaires when all equipment is in operation. A few per cent drop in voltage will cause a considerable drop in light output as shown in Figure 3. For example, with filament lamps, a 3 per cent voltage drop means a 10 per cent drop in light output and a 10 per cent drop means 30 per cent drop in light. The effect of voltage drop on mercury lamps is about the same as for filament lamps. With fluorescent lamps, however, a 3 per cent voltage drop only means 4 per cent drop in light output and a 10 per cent voltage drop results in only 14 per cent illumination drop.

Therefore, to maintain maximum illumination, the lighting supervisor should be sure that luminaires are being supplied with the proper line voltage.

A low line-voltage condition should be corrected and one or more of the following general methods may be used to improve low voltage at minimum cost:

1. Change taps on distribution transformers.
2. Rearrange circuits to balance load.
3. Install booster transformers.
4. Split circuits and install a third wire to serve as a neutral.

In addition to these general methods of correction where low voltage exists, there are certain types that can be taken depending upon the lighting source in use.

Filament lamps are available for 105, 110, 115, 120 and 125 volt circuits. Therefore, filament lamps with a rating closest to the normal line voltage can be obtained if line voltage is between 105 and 125 volts.

Mercury lamp transformers are furnished with taps which can be selected according to the line voltage within certain limits.

Fluorescent lamp ballasts are designed for 118, 208 or 236 volts, but will operate satisfactorily from line voltages that vary plus or minus 7 per cent from the design value. Of course, light output will change with voltage but the variation will not be as great as with filament lamps, as shown on Figure 3.

Maintenance to Save Vital Material

Many plants can increase their illumination level by 50 to 100 per cent just by the use of a little soap and water and proper lamping. Of course, plants that were poorly lighted originally cannot expect perfect lighting without additional equipment, but many factories that have properly designed lighting have poor illumination just because of neglected maintenance. With the present scarcity of materials, it is more important than ever before to keep lighting up to par by regular maintenance to utilize existing equipment to the fullest extent.

Gas for the Eastern Coast

Electrical features of Plantation Pipe Line's longest line, extending more than 1,250 miles, from Baton Rouge, La., to Greensboro, N. C., are described here in considerable detail.

By M. A. Hyde* and H. B. Britton*

PLANTATION Pipe Line Company's new 1,254 mile pipe to Greensboro, N. C., is the largest line system from Baton Rouge, La., ever built for the handling of refined petroleum products and is the largest all-electric-powered line in existence. First full-length delivery was made early in February, 1942 and immediately the line became an important factor in the transportation of gasoline and fuel oils to a large area in the Southeastern states.

General Operating Conditions

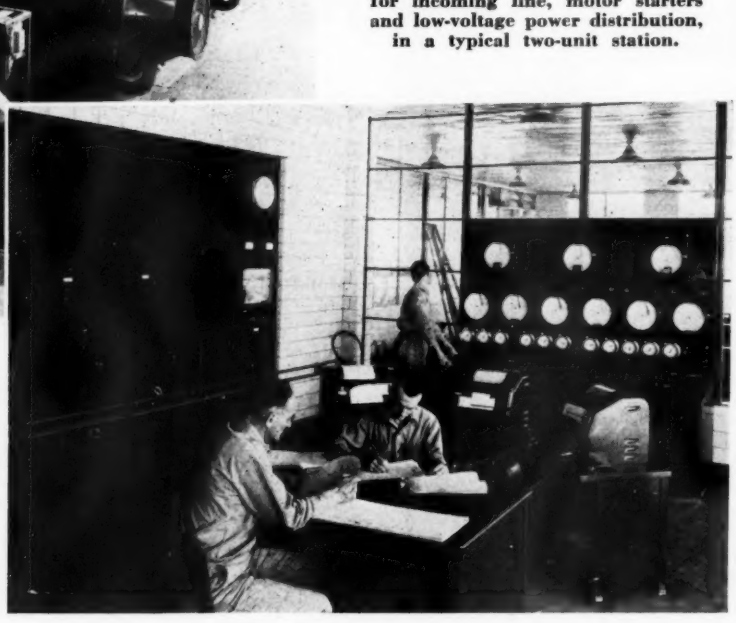
Statements made regarding the capacities, pressures, and horsepowers, both for present operation and future installation possibilities, do not necessarily represent actual conditions, but do indicate the general principles involved.

The system comprises an unloading dock at Baton Rouge, La., with a short line of four parallel 12-inch pipes to a storage tank farm and the initial station of the pipe line proper, a section of 12-inch line, followed by a section of 10-inch line, terminating at Greensboro, N. C. Four branch lines serve areas to the north and south of the main line. The tankage at Baton Rouge, La., Main Line Station is used to store incoming shipments, and to make up pipe line shipments (known as tenders) according to the system schedule. Smaller storage facilities are located at the branch line origins.

Approximately 30 delivery terminals are situated at various points along the system, each with facilities for handling several products. The handling of multiple products to 30 delivery points creates a scheduling and dispatching problem probably far more complex than on any existing line.

Pipe Line Capacity

The capacity of the line as initially equipped is 60,000 barrels per day of gasoline through the 12-inch section and 42,000 barrels per



(Left) Fig. 1. Pump room of typical main-line station on Plantation Pipe Line system. (Below) Fig. 2. Control desk, gauge board, teletype and telephone facilities, and panel for incoming line, motor starters and low-voltage power distribution, in a typical two-unit station.

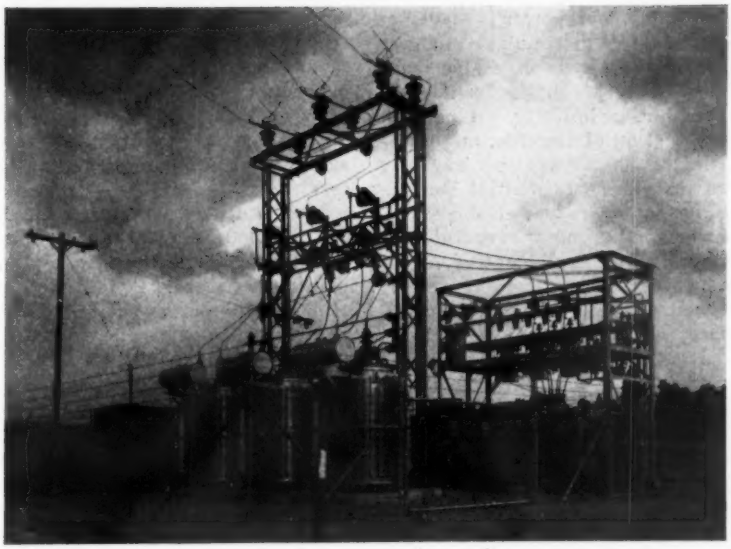
*Adapted from a paper presented before the summer convention of the American Institute of Electrical Engineers, in Chicago, June 21, 1942. Mr. Britton is chief engineer of the Plantation Pipe Line, and Mr. Hyde is industry engineer with Westinghouse Electric and Mfg. Co.

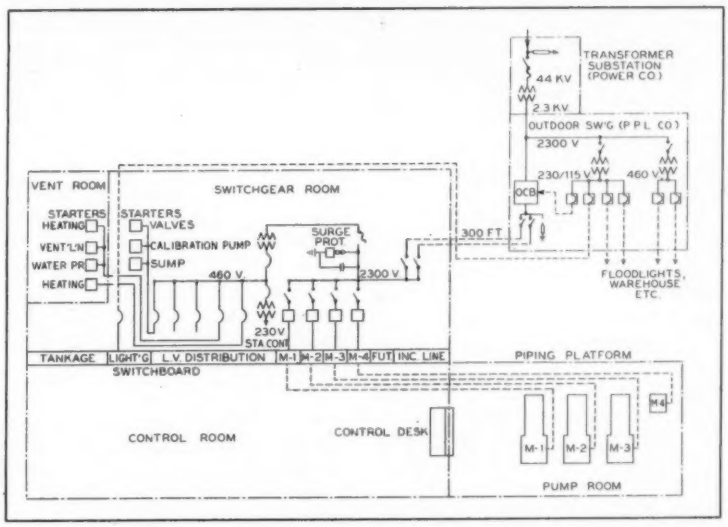
day through the 10-inch section. This requires two 600 horsepower motor driven main-line pumps for each of the seven stations on the 12-inch line, and two 450 horsepower units on each of the seven stations on the 10-inch line. Each of three branch lines is served by a single 150 horsepower unit. A 450 horsepower unit is required at the origin of the fourth branch line, plus an additional booster station requiring a single 450 horsepower unit. The unloading station at Baton Rouge dock contains five 600 horsepower units, providing ample capacity for rapidly unloading two tankers simultaneously. The initial main-line station at Baton Rouge Tank Farm contains a complete spare pump unit to insure the availability of two units at all times. The system comprises 16 stations with a total of 39 centrifugal pumping units exclusive of tankage pumps and auxiliary pumps.

Provisions for Future Capacity

The present installation is designed as a long-term project to cover the commercial needs of the territory served and to operate economically on that basis. At the same time provision is made for possible future operation at increased capacity.

All stations on the main line are arranged for future changeover to higher capacity by initially installing pumps of such design that new impellers can be readily substituted, and motors designed for ultimate operation at the increased horsepower. These motors are of the totally enclosed fan-cooled type, and in order to secure efficient operation of the 12-inch line motors at 600 horsepower, they are equipped initially with a ventilating fan designed to deliver only the amount of ventilating air required by the motor operating at this capacity; when the change-





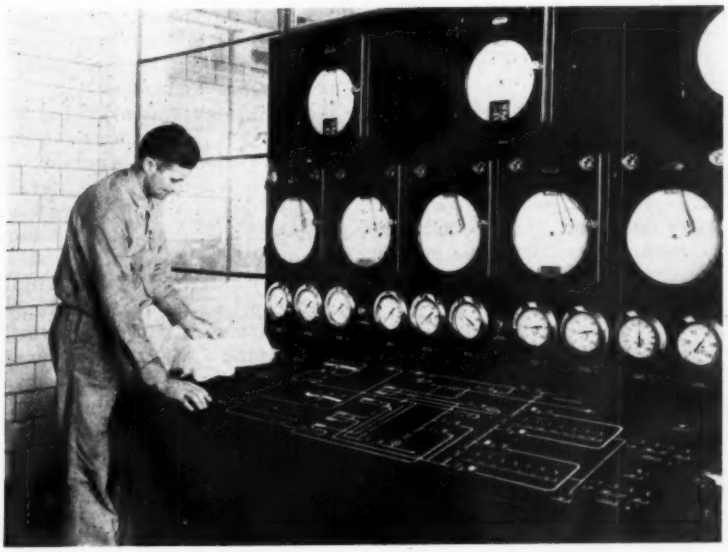


Fig. 3. (Top) Outdoor substation for pumping station serving one main and two branch lines. The 44 kv to 2.3 kv transformer bank consists of three 833 kva units.

Fig. 4. (Middle) Schematic diagram of electric power circuits for pumping station serving main and two branch lines.

Fig. 5. (Bottom) Control desk set into vapor-tight wire-glass partition, through which the pump room is clearly visible.

over to 900 horsepower is made, no electrical or mechanical changes are involved except replacement of this one fan on the front shaft extension. Similarly, on the 10-inch section of the line, motors of ultimate 600 horsepower capacity are installed with initial fan capacity for operation at 450 horsepower. The motor control and power supply equipment in all the main-line booster stations are designed for operation at the ultimate ratings.

Operating Flexibility

All motors 75 horsepower and above are 2300 volt. All motors above 150 horsepower are 3600 rpm. All motors 450 horsepower and above are mechanically interchangeable, simplifying the problem of spare equipment, because a spare motor of 600/900 horsepower design can be installed on any line pump unit in the system except the 150 horsepower branch line units. This feature also provides maximum utility of the equipment under unpredictable future alterations due to changed operating conditions.

While the line is designed for a certain rated capacity, consideration must be given also to its flexible and economical operation at reduced throughputs. Contrary to practice on lines handling one uniform type of tender, the throughput of this must be held above a certain minimum rate, to prevent excessive contamination between adjoining tenders passing through the line. Between this rate and the full capacity of the line it is desirable from the standpoint of power consumption, to operate at a rate as low as will suffice to meet the transportation schedules.

Motors of the constant speed type are preferred because of their simplicity, and their adaptability to construction suitable for hazardous atmospheres. Installation of two units per station, operated at constant speed, with the pumps connected in series, provides the required degree of flexibility. With this arrangement, and with all stations along the line having piping installed to permit by-passing any unused unit or station, changes in throughput in steps of a few per cent can be made by operating 2, 1 or 0 units in properly selected stations.

With the station locations determined solely by the hydraulics of the line and, therefore, without regard to existing power facilities, it was necessary to consider carefully the method of starting the units, from the standpoint of voltage conditions on the electric service.

Most stations contain two main pumps comprising 95 per cent of the station load. From the standpoint of starting conditions the 12-inch line motors are 900 horsepower, and the 10-inch line motors 600 horsepower. The motors are of low starting torque design in order to minimize rotor resistance and attain high operating efficiency, important in view of the high load factor at which the system will operate. To minimize current peaks during starting, motor starters for all units 450 horsepower and above are of the auto-transformer type, with closed-circuit transition. During the brief interval when the motor is transferred to full voltage with its terminals still connected to the starting tap, a reactor is inserted between the auto-transformer tap and the motor to limit the current in the auto transformer circuit. By suitable control this reactor also provides an additional reduced voltage starting step when power is first applied to the motor.

Design for Hazardous Product

Safety problems introduced by the handling of petroleum hydrocarbon products of volatile and inflammable nature required special consideration throughout the design of the stations.

The areas subject to the occurrence of hazardous atmospheres (Class I Group D as defined in the National Electrical Code) are the pump room and adjoining piping platform. The pump room contains the pumps with associated valves, hydraulic control devices and piping. On the piping platform are situated the incoming and outgoing line piping and all necessary station and auxiliary piping with associated scraper traps, strainers, filters, valves, a sump tank with motor-driven pump for its service, and in many stations pressure reducing valves and fluid meter and meter calibration facilities for delivery of product from the line to the distribution terminals.

All electric motors, control, signal devices, motor operated valves, lighting fixtures, and wiring installation in this area are specifically designed for service in Class I Group D hazardous atmospheres.

The 600/900 horsepower motors on the 12-inch line pumps are believed to be the largest, explosion-resisting motors ever built. Attainment of this rating in a relatively compact construction — an important consideration in explosion-resisting design — is accomplished by the circulation of large volumes of cooling air through the motor frame and by the use of Class B insulation with the motor rating based on 75° C. rise. All main-line pump motors have sleeve bearings, oil ring lubricated and cooled by air blast from the motor ventilating fan. These bearings require no oil circulating system, consequently each motor is an entirely self-contained unit without external accessories.

Control apparatus is of dead-front construction. With appropriate measures taken for safety, experience in products pipe-line operation indicates that provision of a non-hazardous location, and installation therein of switchgear and control apparatus of open design, is preferable to the use of special forms of switchgear and control in explosion-resisting or oil-immersed enclosures designed for Class I Group D location. This is true from both cost and operating standpoints. The importance of accessibility hardly can be overemphasized; since the several stations on a pipe line operate in series and interdependently, it is imperative that during operation of the line any inspection and maintenance work on electrical equipment be performed without shutdown, or in emergency with the very minimum of shutdown time.

To provide for safely shutting down the station in case the control room should become hazardous due to an equipment failure, an explosion-resisting "emergency" pushbutton is mounted on the control desk continguous to the gauge board. By pushing this button, the attendant will trip the circuit breaker at the origin of the incoming power feeder.

This breaker, normally controlled from the incoming line panel in the station, is located at the transformer substation ap-

(*Continued on page 22*)

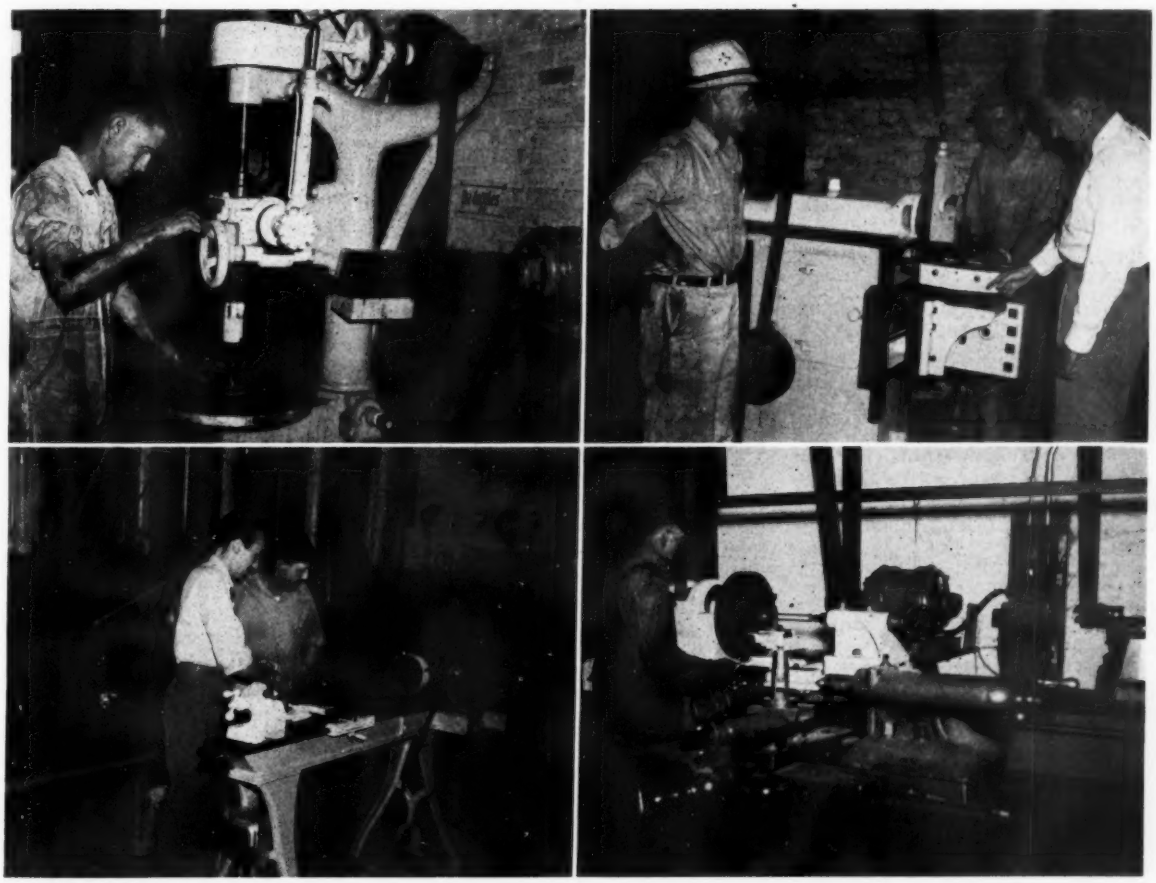
Eliminating "Machine Camouflage"

By Donald L. Moore

CAMOUFLAGE speeds victory on the battlefront but it proves to be one of the worst enemies of industrial production. All too often insufficient lighting, the dull green and black of grease covered machinery and dark walls and floor, blend into a solid, dark mass which camouflages details of the machine tools. Contrasts are lacking, eyes are strained, and hands are slowed down.

To eliminate this "industrial camouflage," there has been developed a new science of "three-dimensional seeing" which covers the application of the right combination of color and light to machine tools to produce greater visibility. This new science is credited largely to Arthur A. Brainerd, director of lighting service, of the Philadelphia Electric Company, and Matt Denning, of the E. I. du Pont de Nemours Company. Practical applications of their "three-dimensional seeing" are numerous. A number of installations in Georgia industrial plants are shown in the accompanying illustrations.

The new science of three-dimensional seeing was first announced publicly in a paper presented by

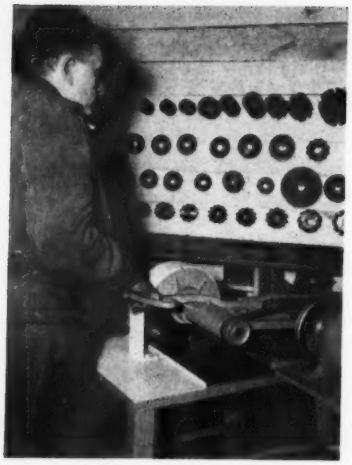


(Upper left.) The Georgia Power Company advocates the painting of machinery for three-dimensional seeing, and it practices what it preaches. For example, note the way this drill press in the Company's garage in Augusta is painted in contrasting colors that increase visibility of work at the machine.

(Upper right.) Superintendent K. L. Steinek and Machinist H. Lotz, of the Planters Cotton Oil Company, in Augusta, listen to the explanation of Georgia Power's Gardner Weigle, lighting engineer, as to why this shaper can be operated faster and more safely now that it has been painted for three-dimensional seeing. All machines in the shop of this company have been brightened similarly for speedier, safer use.

(Lower left.) Joe Browder, Georgia Power Company lighting engineer, discusses the science of three-dimensional seeing with Claude Hatcher, mechanic at the Moultrie Cotton Mill. The small lathe was painted spotlight buff and horizon gray to increase visibility for its operators.

(Lower right.) The difference in appeal and visibility between a drab gray lathe and one painted according to the science of three-dimensional seeing is easily seen in this picture. At his newly painted lathe, Machinist J. G. Bennett finds it easier to see the work and to finish it more quickly. No wonder that 31 other machines in the shop of the Taylor Iron Works, in Macon, were also painted for this greater visibility.



Heretofore, even "home-made" machines were painted drab, poor contrasty colors. But when Superintendent H. R. Mason, of the Taylor Iron Works, in Macon, finished this super-balanced cut-off machine, he dressed it up in spotlight buff and horizon gray—the colors that provide three-dimensional seeing!

Messrs. Brainerd and Denning at the thirty-fifth annual convention of the Illuminating Engineering Society, in Atlanta, last fall.

Since then, foremen and superintendents of machine shops and factories have found that the painting of their machinery for three-dimensional seeing has resulted in increased production, reduced accident hazards, better working conditions, and improved labor relations. At the same time, introduction of the new color science has proved an effective entree and selling tool for utility lighting engineers.

Development of the science of three-dimensional seeing grew out of an attempt to increase the visibility for workers in factories, especially those doing critical seeing tasks at machines. As the coauthors pointed out to the I.E.S. audience: "In the average factory, we have a more or less white ceiling, and all too often the walls are also white even down to the floor. Machines are most frequently green, deep gray, or black, affording almost no color or brightness contrast to the material under fabrication. In such surroundings, piling on high-level lighting does not produce the expected improvement in seeing. It is a great example of camouflage."

Investigation by the men revealed that the actual locations of the working areas of machines for tool and die-making, etc., are obscured by the overall traditional gray paint just as the piano keys would be made indistinguishable if the keyboard were finished in the same color as the walnut or mahogany background. Obviously, such a condition makes for lowered efficiency through difficult seeing.

So Messrs. Brainerd and Denning began experimenting with the painting of the working areas and other parts of machinery in contrasting colors of different tones. Successive experiments were made with light green, yellow, aluminum, light blue and buff, all of which gave more brilliancy than the old gray paint.

Photometric measurements of the light reflected by the different colors revealed that buff was best, closely followed by light gray, aluminum, and then green. At this point, according to a duPont booklet explaining the research project, "seeing conditions" had been improved by creating a contrast in color and brightness between the work and the background. Going a step further, the working area was separated from the mass of the machine by using a light color near the tool area and a darker shade for the remainder of the machine. A medium gray body color with buff around the working areas (both semi-gloss, washable colors) proved to be the best color treatment.

"In addition to providing more light and better seeing conditions at the actual working surface, this combination attracts the eye instantly and clearly 'spotlights' the exact location of the danger point. The action is positive without being too sharp or abrupt to be uncomfortable and produces a three-dimensional seeing effect.

Times Studies Support Theory

"A series of time studies was also conducted on a standardized task to ascertain the effect of the various colors upon actual operating efficiency. Tests were made under both mercury and incandescent light for each color. Reactions of operators after a week's experience were then recorded and computed. The winning combination in these careful studies was buff for the working area and medium gray for the body of the machine — the same combination which, under controlled tests, proved to have the best reflecting qualities.

"During the eight weeks of the test, a psychological survey was conducted among the 15 machine operators to determine their personal reactions to the various colors being tested. The results were weighed with the other factors of color contrast, light reflective factors, and required operating time. By this thorough method, the three-dimensional colors scoring the highest on all four counts were buff and medium gray.

Results of Experimental Study

"It was found (1) that the soft contrasts created by the combination were easier on the eye than abrupt changes in brightness; (2) that these colors were best in reflective qualities; (3) that operating time was faster and more efficient because the lighter tool area concentrated attention on the work and highlighted danger points; and (4) that workers reacted more favorably to the pleasing buff and gray combination than to the other colors tested.

"The chief feature of this color treatment is the three-dimensional effect secured by controlled color contrast. The work in machines so treated stands out sharply in stereoscopic clearness that cannot be achieved by brightness contrasts alone."

Following discovery of the advantages of three-dimensional painting as applied to machinery, the paint technicians and lighting engineers turned their efforts to a study of wall and ceiling colors. Eager to place the paint-treated machinery in appropriate surroundings and to extend further the benefits of easier seeing in shops and factories, the researchers sought out the colors for walls and ceilings that would give the most pleasant, non-distracting effect and at the same time steal the least amount of light.

Light-colored paint on drab walls proved the best solution for this phase of the problem, and light ceilings decreased the "lost-light" problem to a minimum. It was found that "white ceilings and walls reflect the maximum of light. But, in some cases, light colors are preferred to white even at a sacrifice of lighting efficiency. Generally speaking, low-ceil-

(Continued on page 52)

Mass-Production Methods Used on Wiring Project

SOME TIME ago the Navy Department awarded contract to Satchwell & Joseph Electric Company, of Jacksonville, Fla., for wiring a low-cost housing project consisting of 450 apartment units at Jacksonville's Naval Air Station.

Tommy Satchwell of the electrical contracting company says time was the most important factor so he streamlined his installation procedure in a very satisfactory manner. Although the apartment units were located at four different sites several miles apart, the job was completed in about 60 working days without having to call in additional crews of men.

Three hundred of the units were at Cecil Field, 50 at Green Cove located at the Air Station, 50 at Springs and 50 at Banana River, all of which are auxiliary fields of the main station.

An interesting part of the wiring procedure is the fact that the contractor did the entire job with non-metallic sheathed cable in an effort to conserve materials and keep the cost of the job at the lowest possible figure. In substituting the non-metallic cable in lieu of strict Navy specifications calling for galvanized conduit and a very high grade of insulated wire, thousands of dollars were saved in addition to the time required in securing materials. The Navy voluntarily waived the specifications after the problem was explained by the contractor.

It is pointed out that the low cost housing project is classified as temporary housing. Had this been concrete or any type of permanent housing or construction, the Navy specifications would have been followed.

Fused load centers and tumbler type switches were used exclusively. The outlet boxes were specifically designed for use with wallboard exteriors.

Brass and copper lighting fixtures were used in all of the 450 units. These were of the modern type designed for maximum light output with the least wattage.

Number 14 wire was used throughout in the branch lighting circuits and No. 12 in the appliance circuits. This was a slight deviation from Navy specifications, but again No. 14 was used in an effort to keep the cost at a minimum. Each unit was wired for electric range, refrigerator, water heater and circulating type of oil heater. Each building in the group of 450 is identical and the electric wiring arrangement was simplified. Each building contained a three-bedroom unit and a one-bedroom unit or two two-bedroom units. There were three plans for interior wiring and they were respectively identical.

Since speed was the watchword, Satchwell worked out a plan which turned out to be a complete success from the standpoint of efficiency.

Each phase of the job was handled separately and was handled by a crew of men especially trained and previously instructed for the particular installations. Before the job was started the contractor had worked out a detailed plan for his men and specific requirements in the various stages of progress.

A crew of men was detailed to set boxes until this was completed. The second crew pulled in wire and made joints. The third crew set the load centers and ran cables for all range outlets. The fourth crew installed switches, receptacles and plates. The fifth crew hung lighting fixtures.

When the job was finally completed it was tested in every conceivable manner to make sure the entire system was in perfect working order before it was turned over to the Navy Department for acceptance.

Built for civilian workers and enlisted men with families the housing project offers a maximum in comfort and efficiency.

Industrial Wiring Practice

Part 8—War production in many plants requires increased electric circuit capacity. The "thin-wall" wires may be of great value in such installations.

By B. Z. Segall

THE INTRODUCTION of thin wall wiring has given to the electrical contractor and engineer a valuable material to remedy the ills and to rectify the errors in many of our older wiring installations. In the 1940 Code four distinct types of wires are described and made available for installation. These were fully described in an earlier article but will be briefly reviewed here.

Type RPT has a performance grade of rubber capable of being operated at a maximum temperature of 60° C. (140° F.). Its rubber wall thickness is 1/64-inch less than the old Code standard rubber covered wire. It is recognized in sizes No. 14, 12, and 10.

Type RHT is similar to RPT but can be operated at a maximum temperature of 75° C. (167° F.). It is made in sizes No. 14, 12, 10, and 8.

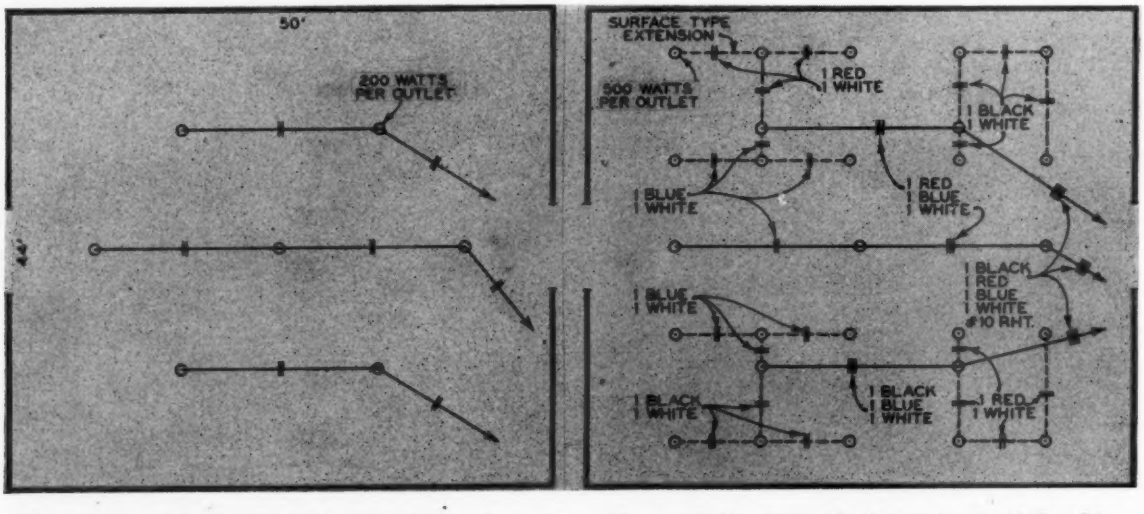
A third type of rubber has been introduced for the first time as an insulator for general wiring, Type RU. This is an unmilled, grainless latex having a 90% rubber content. The thickness of this rubber wall is .018 inches or a little more than 1/64 of an inch. This wire is made in sizes No. 14, 12, and 10.

All three of these wires require an outer braid covering to protect the rubber insulation. These braids are treated to be moisture resistant and flame retardant. The Type RU will have the smallest overall diameter of the three types due to its thinner wall of insulation.

A fourth type, known as SN, is another new type of wire insulation for general wiring practice. This is a pure synthetic material applied directly to the wire without any supplementary braids, etc. It is made under various trade names and a more or less complete list was shown in a previous article. The wall thicknesses vary since this wire is made in all sizes from No. 14 to 4/0, inclusive. Sizes No. 14, 12, 10, and 8 have 1/64-inch less wall thickness than the old Code rubber wire. The other sizes have the same thickness. However, there is no overall braid covering on these wires so that the net overall diameter is less than the comparable wire sizes with standard rubber insulation. In sizes No. 14, 12, and 10, its overall diameter is practically the same as the Type RU diameter. Its maximum operating temperature is 60° C. (140° F.).

Type RPT, RU, SN wire are to be used for rewiring installations only. All new work or new extensions to existing wiring systems has to be made with standard grades of wiring or with the Type RHT thin-wall wire. It should be emphasized that Type RHT is the only grade of thin-wall wire approved both for new work and rewiring.

Table 6 of the Code shows the number of conductors which can be placed within an existing conduit if rewiring is to be expedited with Type RPT or RHT wire. For example, nine No. 14 wires may be extended in a 3/4-inch conduit. Standard diameter wires will require a 1-inch conduit. The practical value of this can be shown by an illustrative example. Figure 22 shows a simple layout for an


50'
200 WATTS PER OUTLET
SURFACE TYPE EXTENSION
500 WATTS PER OUTLET
1 RED 1 WHITE
1 BLACK 1 WHITE
1 BLUE 1 WHITE
1 RED 1 BLUE 1 WHITE
1 BLACK 1 RED 1 BLUE 1 WHITE #10 RHT.
1 BLUE 1 WHITE
1 BLACK 1 WHITE
1 BLACK 1 BLUE 1 WHITE
1 RED 1 WHITE

Figs. 22 and 23. These "before and after" rewiring diagrams illustrate the importance of the thin-wall wires, such as types SN, RU, RHT and RPT for modernizing existing installations.

TABLE 6—NUMBER OF CONDUCTORS IN CONDUIT OR TUBING

Small Diameter Building Wire, Types RHT and RPT, 600 Volts

One to Nine Conductors

For rewiring in existing raceways as provided in sub-paragraph e of section 3005.

Size of Conductor	Number of Conductors in One Conduit or Tubing								
	1	2	3	4	5	6	7	8	9
14	½	½	½	½	½	½	½	½	¾
12	½	½	½	½	½	¾	¾	¾	¾
10	½	½	½	½	¾	¾	¾	¾	1
8	½	½	¾	¾	1	1	1	1	1¼

Note.—Type RHT conductor recognized in sizes No. 14 to No. 8; Type RPT conductor recognized in sizes No. 14 to No. 10.

See Note 5 to Tables 1 and 2.

TABLE 7—NUMBER OF CONDUCTORS IN CONDUIT OR TUBING

Synthetic, Type SN and Type RU, 600 Volts

One to Nine Conductors

For rewiring in existing raceways as provided in sub-paragraph e of section 3005.

Size of Conductor	Number of Conductors in One Conduit or Tubing								
	1	2	3	4	5	6	7	8	9
14	½	½	½	½	½	½	½	½	½
12	½	½	½	½	½	½	½	¾	¾
10	½	½	½	½	¾	¾	¾	¾	¾
8	½	½	½	¾	¾	¾	1	1	1
6	½	¾	¾	1	1	1¼	1¼	1¼	1¼
5	½	¾	¾	1	1¼	1¼	1¼	1¼	1½
4	½	¾	1	1	1¼	1¼	1¼	1½	1½
3	½	1	1	1¼	1¼	1¼	1½	1½	2
2	½	1	1	1¼	1¼	1½	1½	2	2
1	¾	1¼	1¼	1½	1½	2	2	2	2½
0	¾	1¼	1¼	1½	2	2	2	2½	2½
00	¾	1¼	1½	2	2	2	2½	2½	2½
000	¾	1½	1½	2	2	2½	2½	3	3
0000	1	1½	2	2	2½	2½	3	3	3

Note.—Type SN conductors recognized in sizes No. 14 to No. 0000; Type RU conductors recognized in sizes No. 14 to No. 10.

See Note 5 to Tables 1 and 2.

Type SN conductors without an outer covering and Type RU conductors with an outer covering have the same overall diameter. See Table 15.

TABLE 11—COMBINATION OF CONDUCTORS

(See sections 3466 and 3487)

For groups or combinations of conductors not included in the Tables 4 to 10, it is recommended that the conduit or tubing be of such size that the sum of the cross-sectional areas of the individual conductors will not be more than the percentage of the interior cross-sectional area of the conduit or tubing than as shown in the following table:

Per Cent Area of Conduit or Tubing

	Number of Conductors				
	1	2	3	4	Over 4
*Conductors (not lead covered).	53	31	43	40	40
Lead-covered conductors.....	55	30	40	38	35
For rewiring existing raceways with thinner insulated conductors as provided in 3005-d and e....	60	40	50	50	50

For carrying capacity of more than three conductors in a conduit or tubing, see Tables 1 and 2, Note 5.

See Tables 13 to 19 for dimensions of conductors, conduit and tubing.

*For Type RHT conductors used for other than rewiring in existing raceways, the areas shown in Table 13 shall be used in place of the areas shown in Table 14.

These tables reproduced from the 1940 Edition of the National Electrical Code indicate the number of "thin-wall" wires that may be installed in various sizes of conduit or tubing.

existing installation feeding seven ceiling outlets on one two-wire No. 14 circuit. Each outlet feeds a 200-watt lamp thus creating a total load of 1.4 kilowatts. Figure 23 shows the rewired installation. Surface-type extensions were made as shown on the ceiling thus eliminating any cutting of the concrete ceiling. All circuits were rewired with No. 10 RHT. The Type RHT wire had to be used since new extensions were added to the old system.

The rewired system fed twenty-three 500-watt lamps or a total of 11.5 kilowatts or 8 times the original load. This same system can be used for a total maximum load of 35 kilowatts.

The breakdown of costs shows a total material expenditure (exclusive of fixtures) for wire, new branch circuit panel, and individual canopy type switches for each unit, to be $114.30. Labor was $118.25 for a total of 157½ manhours. This shows a prime cost of approximately $10 per outlet.

Table 7 shows the number of Type SN and RU wires which can be installed in conduit. Due to the smaller diameter, smaller conduits will be required than for the installation of Type RHT and RPT. Thus nine No.14 Type SN or RU wires require a ½-inch conduit. As a further comparison, nine No. 8 Type RHT wires require an 1¼-inch conduit, whereas nine Type SN wires will only require an 1-inch conduit.

The Type RPT, RHT, and RU wires will be more or less limited to small feeder and branch circuit rewiring since No. 8 and No. 10 are the maximum sizes available. The use of the Type SN is more extended since it is available up to No. 4/0.

The selection of any one of the four types of thin-wall wires available will depend upon a number of factors. As shown above, the type SN and RU are smaller wires and can be installed in smaller conduits. However, type RHT has the advantage of having a greater current carrying capacity due to its higher operating temperature.

The code further provides for an increase fill of conduit for rewiring installations. Thus Table II shows that all new installations still must not exceed 40% fill where more than three conductors are installed in a conduit. For rewiring of an existing conduit installation, this may be increased to 50% fill. It should be noted, however, that where Type RHT is to be used for new work, the percentage fill is to be based on a 40% factor and not 50%. Thus Table 4 must be used whenever Type RHT is to be installed on new work.

The Edison Electric Institute has published two handbooks which deal entirely with the design of rewiring installations. One book entitled "Commercial and Industrial Building Rewiring Market" gives basic data and some examples of rewired buildings. The second booklet "Rewiring for Commercial and Industrial Buildings" gives somewhat more pertinent data on actual design and will be of great help in rewiring design.

The various manufacturers have published bulletins and handbooks dealing with building rewiring. All of these present a practical approach to the problem of rewiring and should be consulted for ideas and solutions of rehabilitating old installations.

Quite a bit of discussion and questioning has been aroused by the introduction in the Code of these new rules on rewiring and on the materials themselves. If these wires are good enough for rewiring why should they not be satisfactory for all new work? Why has only Type RHT been approved for both rewiring and new work? If a thinner insulation is safe and ample for rewiring why not adopt it for all new installations? Why limit the thinner insulation to the smaller sizes? Why have so many types?

New Type Wire Recommended

The recent reports of the Article Committees of the NFPA Electrical Committee for the revision of the 1940 Edition of the Code attempts to eliminate some of these questions and clarify others. Thus the committee recommends a new type of wire to be known as Type R but to differ from the present Code grade Type R in several respects:

(1) It will have a performance grade of rubber insulation capable of being operated at a maximum temperature of 60° C., instead of 50° C.

(2) It will be available in sizes No. 14, 12, 9, and 6, thus eliminating sizes 10 and 8 in favor of a more practical size No. 9 having a 30 ampere capacity, i.e., the maximum size plug fuse and the transition point in cut out and fuse block manufacture.

(3) It will have a thinner wall of insulation thus being a general use thin wall wire and the only thin wall wire of the straight rubber compound types available since it is being recommended that both RPT and RHT be eliminated.

This wire will have the current carrying capacity of the present Type R. As for conduit fill, Table 6, applicable to Type RPT and RHT is recommended. This will have to be corrected to replace the No. 10 and No. 8 size with the new No. 9 size and extended to include No. 6. Thus full advantage may be taken of the thinner wall of insulation under all conditions of wiring, new or old.

For wire sizes No. 6 and above, the committee recommends that such wires be insulated with a heat resistant type of rubber only. The No. 6 size will be slightly thinner in wall thickness than the present day standard wire, i.e., 3/64-inch instead of 4/64-inch. All the other sizes will have standard wall thickness.

The effect of a 1/64-inch thinner wall for the braided covered rubber insulated wire on the overall cross-sectional area is greatly decreased for the larger sizes. Thus for a No. 14 solid wire the braid and rubber occupy about .027 square inches and the copper but .003 square inches of the cross-sectional area, or a ratio of 9 to 1. For a No. 6 this is cut down to a ratio of 4 to 1 since the braid and rubber are .104 square inches and the copper .026 square inches. For 500,000 cir mil wire, it is less than 1, since copper is .54 square inches and insulation but .45 square inches.

RU and SN for General Use

The committee further recommends the general use of Type RU and SN wherever the use of Code grade rubber is now recognized. Table 6 would be used for determining the number of conductors permitted in a conduit for sizes No. 14, 12, and 9. Thus the thin wall fills would be extended for application to these wire sizes. Above size No. 9, which would, of course, apply only to the Type SN, Table 4 showing standard conduit fill would be used. These changes would eliminate Table No. 7 which is now applicable to Type RU and SN cable.

The above recommendations relative to Type SN and RU cable have been given approval for the duration of the War Emergency. If the Electric Committee ballots its approval of the above changes then it will carry over as a permanent Code rule and apply as well to all construction after the emergency.

The general effect of these recommended changes is to eliminate the old Type RP, RPT, RHT and substitute a new Type R for sizes up to No. 4 only. RH from No. 6 and above, and still retain RU and SN. All these changes will simplify the Code and certainly make the manufacturers' job easier.

Electrical Features Of Gasoline Pipe Line

(*Continued from page 16*)

proximately 300 feet from the pumping station. From the outdoor breaker, an underground circuit runs to a 2300 volt bus in the switchgear room, which in turn feeds the main pump starters as well as a 2300/460 volt transformer bank serving all the station auxiliaries. Energy for the control circuits of the motor starters and for signal lights and alarms is furnished at 230 volts through a transformer from the station auxiliary supply. A single-phase transformer connected to the 2300-volt service ahead of the station power breaker supplies station lighting and outdoor lighting at 115/230 volts through separate low-voltage outdoor breakers. At some of the stations there are loads outside the station proper, such as fire pumps, water well pumps, and warehouse, which must be operatable even when the pumping station is shut down. To carry these loads, as well as the lighting load, a 2300 volt bus is provided on the outdoor structure, connected to the power service ahead of the station power breaker. To this outdoor 2300 volt bus are connected the station bus breaker, the lighting transformer, a 2300/460 volt transformer bank for outside auxiliaries and a fire pump circuit.

Physically the control for each station centers in a control desk in the control room, where also is situated the gauge board, the attendant's working desk, and a teletype operating over a circuit serving the system dispatcher's office and all pumping stations.

Red indicating lights on the control desk identify the functioning of each of the protective shutdown and alarm switches. Amber and green indicating lights show respectively the open and closed positions of the motor-operated suction and discharge valves, and of the principal manually operated valves in the station piping.

To clarify the function of each device the desk top bears a schematic layout of the principal piping for the particular station, and in this piping diagram the indicating lights, temperature indicator, ammeters, selector switches, and push buttons are all mounted in appropriate position.

Time-Saving Technique For Housing Project Wiring

THE FEDERAL Public Housing Authority has developed special time-saving techniques for installing plumbing and electrical wiring in prefabricated houses for war workers.

Because so many types of prefabrication are being employed in the extensive war housing program, manufacturers and builders have had many opportunities to devise technical short cuts.

Photo 1 (site-fabrication—Childersburg, Ala.) shows pre-cut wire, ready to be installed, hanging on pegs on the outside of a site work-shed. The wire was cut inside the shed, the ends bared and stripped, and the copper cleaned. When an electrician is ready to begin work on a house, he walks from one peg to the next, picking up the number of lengths of each type of wire needed for that particular house.

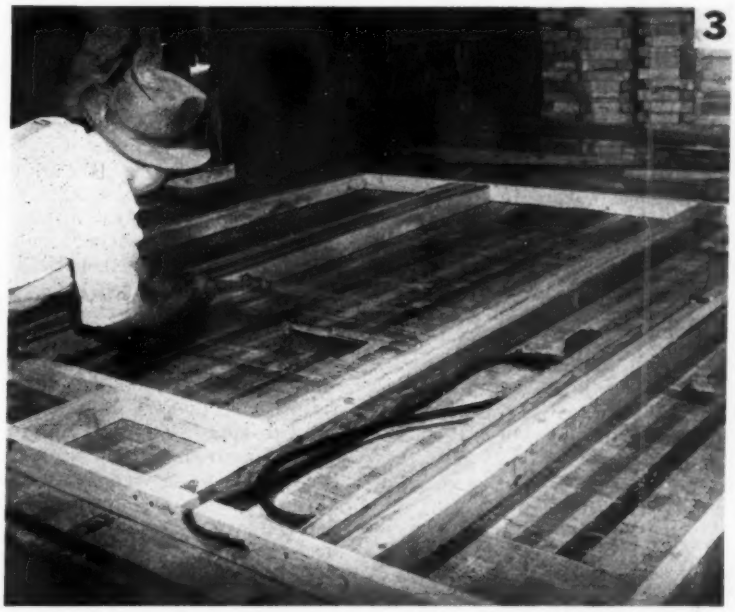
Outlet boxes are built into the wall panels while they are still in the jig. Chases are provided for the wiring by rabbeting structural members of the panels so the electrician can fish the wire through after the building is erected.

Sometimes chases are provided by rabbeting exterior stud members of exterior and interior wall panels at the base. Wiring is installed conventionally after erection, and the base applied by the carpenters when they trim out.

Photo 2 (factory-fabrication—Norfolk, Va.) reveals how panels are pre-wired during manufacture in the plant. Wiring and boxes are installed before the panels are closed and sealed.

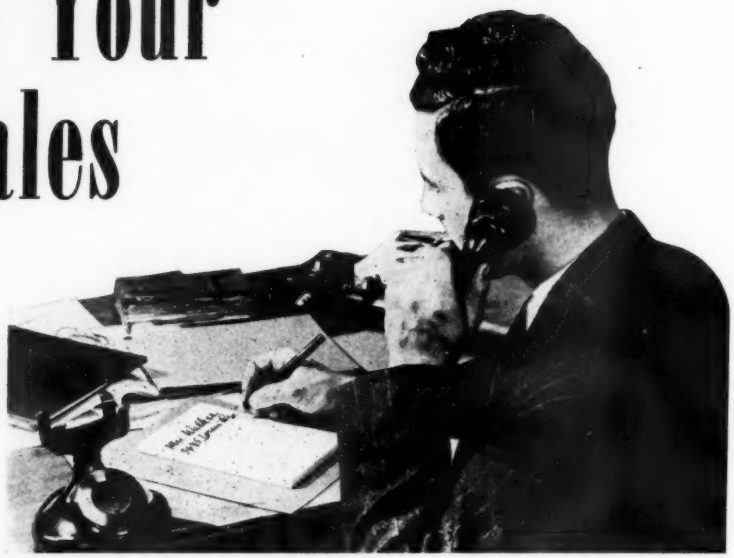
Photo 3 (factory-fabrication—Norfolk, Va.) shows the main entrance cable and panel box being attached to a supporting stud.

Various systems are used to connect the trailers of wire. Sometimes they are attached to connector points, which connect automatically when the panels are bolted together during erection. Often the trailers are picked up in a spider web over the ceiling or under the floor, and connected at the site with conventional junction boxes.



Promoting Your Service Sales

By L. K. Baxter*



Proper use of the telephone is a valuable aid in building up your service business, Mr. Baxter points out. It is important to get the correct name and address when a customer calls in. And be sure to write them down. This is one of the nine rules to follow in using the telephone which are explained in Mr. Baxter's article.

AFTER discussing the subject "Can Service Pay Its Way" (last month's article) quite essentially follows a discussion of the problem of properly promoting your business to realize to the fullest the service potential in the area you serve. Keeping open your doors on service business alone is certainly not easy, and the only way it can be done is by seeking out every possible service job in your market.

Now that civilian goods production has stopped completely in the appliance field we see increased interest and concern on the part of the consumer over the condition of the equipment he now has. As your inventories of new appliances run out, the cold realization that there are no more available will dawn on your customers.

The full impact of no more new appliances and the need for conservation and proper care of existing equipment has not yet hit the American consumer—he has too long been accustomed to lush times, easily available replacements whenever the slightest trace of trouble occurred. We've already seen it work in the case of tires. For a long time people just refused to believe that no more would be available, refused to take the necessary conservation steps for proper care and protection. But now they know the bitter truth, and are acting accordingly. And so it will be with appliances—a growing realization that what they now have has got to last.

The consumer's mind will rapidly become conditioned to this new philosophy of save and keep in good repair. Therefore, your message to him telling of the help and assistance you have to offer will find a welcome audience. Now let's see how this message can best be carried to the people you want to reach. Here are some tested promotional steps that have already been proved effective in building the necessary volume on service and repair.

Survey Your Territory

The first step for any dealer is to survey his town and find out how many appliances are in use. Specific information of this type can be secured from the local utility. Or you can take national averages and apply them locally.

For every 100 wired homes nationally there are approximately 70 refrigerators, 60 electric washers, 12 electric ranges, 50 cleaners, and 350 small appliances. If local figures are not readily available, you can apply these national averages to your area. Now consider the number of service shops available to handle this business, and determine what your share would be.

This is the kind of an analysis you need to make to know what your potential service market amounts to. This will direct your thinking in arriving at the size organization you can support, and the amount of promotion you can afford.

Building a Mailing List

The second job in the promotion of this business is to make up a mailing list of customers and prospective customers. There are a number of sources you can employ in building this list. First is your customers. Second is the names of people who come into the store. A third is the names of people who have had you service appliances for them. Get these from sales slips, from service orders.

These three groups can form the basis of a very good mailing list. Another way to add names is to pick names from the telephone book. Take these from the better neighborhoods of town and you will have the people who are most likely to own the greater number of appliances. The value you get out of your mailing list is in proportion to the care you take in making it.

The responsibility of keeping up a mailing list is not something you

*This is the second article of a series by Mr. Baxter, who is manager of merchandise service for Westinghouse Electric & Manufacturing Company, of Mansfield, Ohio.

can delegate entirely to the girl in the store. Spend some time on it yourself. Be sure the names and addresses are correct. Some people resent it when you spell their name incorrectly. It's silly to mail a man a piece which asks him to do business with you without taking the trouble to find out how to spell his name or to get his correct initials. The telephone book is the easiest way to verify name, initials, and address.

Keep your mailing list on cards instead of a typewritten sheet. You can file cards alphabetically and find a name more easily. Additions or cancellations can be easily made on cards without disturbing other names. You simply make out a new card or make changes on the old one.

You should go over the mailing list regularly. When you read in the paper that someone moves out of town take the name off the list. If they move to a new part of town, make the proper address change. The value of a mailing list is directly dependent on interest you take in keeping it up-to-date.

Make Regular Mailings

Regular mailings to your list of prospective service customers is important to keep reminding them that you are ready with complete service facilities to handle their needs. This mailing may be a simple postcard on which you have written a reminder that you are there to service electric appliances. One simple method is to write a short letter and then have your girl type so many of these every day. Don't try to write a long letter which tells all. A letter of one paragraph, asking for service business will get you results. People will read short letters more readily.

If your girl has time to write five letters today, let her write five; if she has time to write ten, let her write ten. Ten letters per day will bring in service business. In any mailing you do not want to send out a large number at one time. For instance, if you are planning to mail 300 postcards, mail them twenty-five per day for 12 days. This will level off the number of calls you will likely get each day and it will stabilize the working load of your repair man.

One big advantage of this mail advertising is that you can adjust the costs to fit your situation. For a few dollars a month, you can mail enough post cards or letters to get you business.

Advertise in Newspapers

A small advertisement in the newspapers reminding people that you are ready and willing to service appliances, will bring you many service calls. Use small space and repeat frequently urging people to take that stitch in time.

Identify Your Store

Let everybody know that you service electric appliances. Put a sign in your window, a decalcomania on your store front, and on the sign which is up over your store, be sure you have some lettering which tells people that you service appliances.

Proper Use of the Telephone

You can use your telephone to promote service business. Start with those people who call in asking for service. The impression a person gets when calling you has a lot to do with what she thinks of you and your service operation. If the person in your store who answers the telephone acts as if he doesn't know anything, the prospective customer will look elsewhere. Don't let just anybody answer the telephone.

Make a list of rules for answering the telephone. Then have some one person, if possible, detailed to answer the phone, and instruct everyone who may answer to use the same routine.

1. Give the name of your company, and the name of the person speaking, so that the caller knows he has the right number.

2. Repeat her name and write it down so that you won't have to ask "What's your name, again?"

Orderly workmanship by your service man is important if you are to give satisfactory service. Mr. Baxter explains that service men should be instructed on how to handle themselves on a call. The little courtesies you demonstrate, such as spreading a cloth for tools to keep the customer's floor clean, go a long way in promoting customer good will.

Then ask for her address.

3. Be cheerful and interested in the customer's problem.

4. Be sympathetic to the customer and the customer's trouble.

5. Ask questions to find out what is wrong.

6. If the customer has an idea that she knows what the trouble is, don't argue with her, even though you know she is wrong.

7. Make practical suggestions. Maybe the plug is out, or the current is off. Ask her to look, or to try to turn on a lamp. In this, you are showing interest in her trouble, and are trying to help.

8. If it is a small appliance, ask them to bring it in, explaining that they save on the repair job price by doing this.

9. If a home call is required, make a specific date and time when she is certain she will be home.

Put Uniforms on Your Service Men

Put uniforms on your service men. A man in uniform looks more competent and as he goes about town, he advertises your store. In the summertime, it's easy to do this. Get your men work suits and put your insignia on them. This with a cap makes a good looking uniform. Then make arrangements with the men so that you keep these uniforms clean.

Teach Service Men How to Handle People

These service men who go out from your store represent you in the customer's home. It will pay you to spend time with them, teaching them how to handle people. You know from experience that they meet all kinds. You should teach them to be cheerful, sympathetic, businesslike, to clean up after they have finished the job, and to leave the customer satisfied. And by all means, urge them not to talk too much, not to try to show off how much they know.

Don't overplay the seriousness of the repair job. This only tends to confuse the customer and give rise to a fear that a major service repair and consequent high cost will result. Give her a simple appraisal of the cause of trouble. Help to ease her mind with the impression that you have correctly diagnosed the trouble and that you are competent to repair it.

Start an Asking Campaign

Get everybody in your organization to ask, "Is there anything else?" One of the surest ways to get service business is to ask for it. When people go into your store, they think about the errand which brought them there, not about the appliance at home which needs fixing. And they won't think about the ailing appliance at home unless you remind them of it. Perhaps you have always asked shoppers, "Is there something else?" If you have, you know it brings sales.

Let's vary that now and ask everybody this question: "Do you have any appliances which need repairs?" Teach every employe who meets customers to ask that question. Have clerks in the store do it, have our delivery men do it when they deliver a package at home. Have service men do it when they finish a call. Ask that question enough and you will be surprised at the amount of business it brings in.

Use Neighbor Calls

To promote additional repair business and to cut down the cost per trip, it is often advisable to check other people in the neighborhood of the call. If you have all the service business you can handle, this, of course, is not necessary. However, if the work schedule for your service shop is not loaded, instruct your repair man to stop at houses on either side of the point of call to inquire if they have appliances that need to be repaired. This will prove a source of additional business, and will lower the cost of the trip he has been required to make.

Offer Special Service "Deals"

If further stimulation is needed to promote more business for your service shop offer special service "deals" to your customers. Work up an economy plan that will pull customers. For example, you may want to offer for a flat price a complete refrigerator check-up service and a merchandise item such as a water bottle, or a crisping tray. Let's say the water bottle lists for two dollars and the service check-up for three dollars. Here is a five dollar value you may want to offer for a limited time only at $2.95. The response to "deals" of this type has been good because of the growing consciousness of the importance of proper conservation of equipment.

Specials of this kind will bring new customers to you and will open up avenues for additional repair business. People reading your newspaper ads announcing your special economy plan may not feel the immediate need for it, but they will likely remember your name when future service is required by them.

The above promotional methods that are recommended are not new. They have been the very backbone of successful merchandising. You likely have used some or all of them in building up over the years your volume of new merchandise sales. Now it's time to take these

(Continued on page 52)

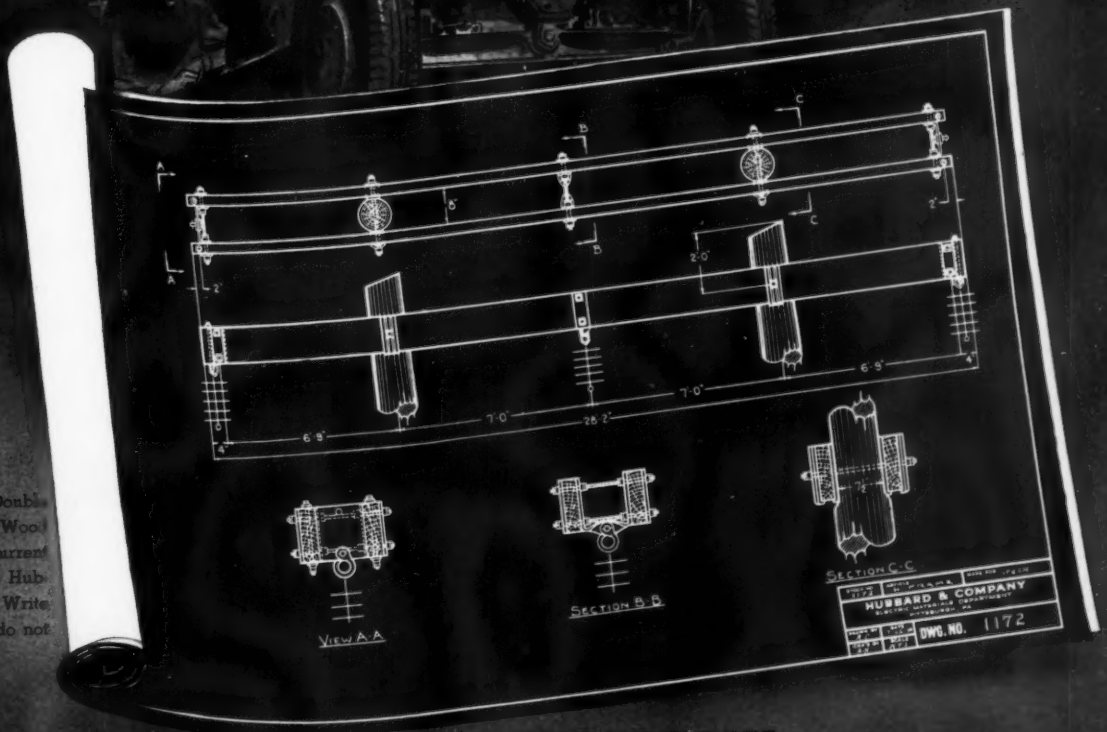
"Forgot your wallet, huh? I have a mind to cancel your order!"

THE STRUCTURE

FEEDING THE FACTORY

BACKING THE MAN

BEHIND THE GUN



For details on this Double Plank H-Frame Wood Structure see the current July issue of "The Hubbard Linebuilder". Write for a copy if you do not have one.

HUBBARD AND COMPANY

PITTSBURGH · OAKLAND · CALIFORNIA · CHICAGO

"HANG THE LOAD ON HUBBARD HARDWARE"

The Navy's way of saying "Well done!"

THE men and women who work in our Electrical Wire and Cable plants now proudly wear the emblem bestowed by the Navy for notable production achievement. Formal presentation of the Navy "E" award was made June 17, 1942.

The entire American Steel & Wire organization is proud of this tribute, especially because production records are not made by plants and machines, but by the men and women who operate them. The Navy "E" will be a constant inspiration to greater effort and still better records.

The government, of course, has first call on every foot of wire and every product we make. And every person in our employ is determined that wire and more wire, faster and ever faster, shall be our answer to the enemy until the day when Victory is ours.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* • United States Steel Export Company, New York

ELECTRICAL WIRES AND CABLES

American Steel & Wire Company Electrical Wires & Cables are serving in the vital job of transmitting and distributing power and light. They are manufactured under the closest control, from the first operation to the last, and embody all latest improvements in design and construction.

UNITED STATES

USS
STEEL

Meeting the Emergency

Appliance dealers rapidly make the adjustments necessary to stay in business. As these brief sketches indicate, they plan to "stick it out"—there's no defeatism here!

WAR CONDITIONS have brought about extensive readjustments in the business of the Tanner Electric Co., of El Reno, Okla., but meeting these readjustments promptly has prevented any serious dislocations of revenue, according to E. Tanner, owner of the business.

He closed the commodious and attractive showrooms that had been occupied on a main business street of El Reno shortly after government officials announced that "business as usual is out." He stored sales room furnishings, built a small frame shop back of his home in the residential section, and shifted entirely to electrical repair and industrial installation operations.

Few of Mr. Tanner's customers know where his business is now operated. No street location is given in Tanner Electric Company advertising—only the name of the firm and a telephone number. Nevertheless that name and number, carried in bold-face type in each advertisement, plus a cut and a few lines of "copy," are bringing the company more electrical appliance repair business than was even expected.

"We run an advertisement twice each week in local daily newspapers, usually on Tuesdays and Fridays," Mr. Tanner explains. "We center our message around the necessity for conserving household appliances, equipment and materials for the duration of the war and suggest that the reader look about to see if any appliances need repairing or if any discarded pieces of equipment can be placed back in service.

"These advertisements are bringing in from 15 to 20 telephone calls per day which request repairs of old electric refrigerators, radios and other appliances and keep two repair men constantly busy. Of course, the war has brought us some new industrial installation business. These two classes of work keep five men busy and have resulted in an increase of approximately 150 per cent in repair and installation business since December of last year."

Mr. Tanner says that the closing of his attractive downtown sales rooms, and the substitution of advertising for sales personnel, have reduced his overhead from 24 per cent of gross sales to approximately 8 per cent.

Aside from the effective power of properly executed advertising, the company's business standing in its community, and its aboveboard methods of dealing with its customers have helped in making the quick and successful readjustment, Mr. Tanner believes.

He explains that customer's bills are made out in triplicate. They are copied from the original work order upon which the repair man or installer entered itemized information showing just what he did and why he did it. Time of the workman and costs are set opposite each item on the bill.

The customer may use this bill as a basis for making out his income tax returns. The itemized bill also is a source of confidence on the part of the customer that nothing was hidden from him in the operation. Any worn out part is enclosed in an envelope or other wrapping and returned to the customer with the piece of household equipment repaired.

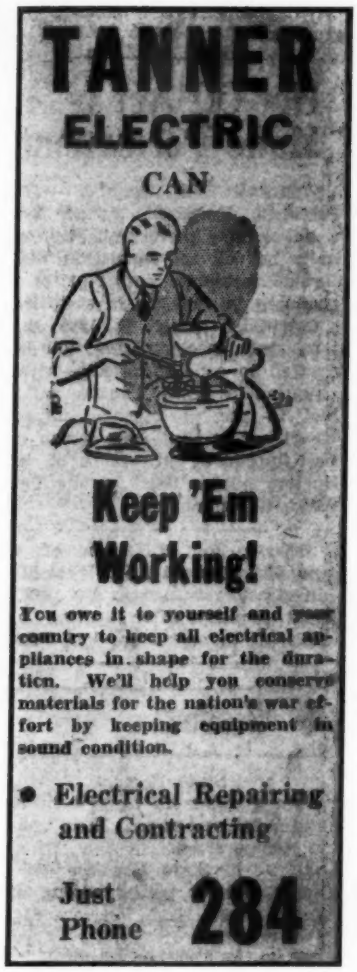
* * *

THE AUFFORD-KELLEY Co., Inc., of Miami, Fla., has developed what has proven to be an effective method for building up electrical appliance service volume.

Believing that its interests best would be served by concentrating on the merchandising end of its business, the firm until recently did no repair work. Therefore, when the company decided a few months ago to add a service department, it had to start its promotional effort.

Located in one of Miami's better "homes sections," Aufford-Kelley

TANNER
ELECTRIC
CAN
Help You
Conserve!
Call a Tanner Service Man to keep your home equipment "in condition" for the duration. That's one way you can follow Uncle Sam's orders to "take good care of the things you have!"
• Electrical Repairing and Contracting
Just Phone 284


TANNER
ELECTRIC
CAN
Keep 'Em Working!
You owe it to yourself and your country to keep all electrical appliances in shape for the duration. We'll help you conserve materials for the nation's war effort by keeping equipment in sound condition.
• Electrical Repairing and Contracting
Just Phone 284

This series of newspaper ads is bringing Tanner Electric Company of Reno, Oklahoma, more appliance service business than he even hoped to get. The ads feature the name of the firm and its phone number.

began to create a service clientele by circularizing residents in its own community. This plan has several advantages. For one thing, practically all of the homes in that area have electric kitchens, and are well-supplied with small appliances. For another thing, service calls often can be grouped —several made in a single trip— making possible a necessary saving on tires and gasoline.

For this localized sales-effort the firm used an ordinary penny postcard on the reverse side of which were listed 15 major and minor appliances. The items include refrigerators, ranges, washers, toasters, vacuum cleaners, waffle irons, sewing machines and lamps. Over the listing are the words "For Service or Repairs," and in smaller type, "Tack Me Up In the Kitchen."

"This postcard," says H. E. Luck, Aufford-Kelley's service mechanic, "is a real business-getter. Many people have poor memories for names. Therefore, the card does good service as a reminder. In making calls, we often find one of our postcards tacked up on the wall near a refrigerator or a range."

During the three years the firm has been selling appliances, it has done a volume business on all-electric kitchens. To these customers and other purchasers of appliances, the company sent an announcement informing them of the new department, and soliciting their repair business. Those announcements, too, have brought excellent results. Aufford-Kelley also has used newspaper display and radio advertising but finds that these mediums have less "pulling power" than direct-by-mail selling.

So far, the company has had no great difficulty in getting necessary repair parts but already is canvassing the possibilities of making up certain types, if the need arises. Mr. Luck, who has been doing appliance service work for the past 15 years—ten of them in the employ of an Ohio utility, is experienced in handling machine tools.

"We find," says Luck, "that appliance owners seem to have become very 'service conscious.' They realize that they may not be able to buy new appliances for some time to come. Therefore, they want to maintain those they now have in as good condition as possible. At any rate, we have dug up enough repair business to keep one man on the jump."

* * *

NOW THAT priorities are seriously hampering residential wiring, the Electric Construction Company, Little Rock, Arkansas, is making its attractive gift shop "pay the rent" and maintain floor traffic.

About one-fourth of the long store has been converted into the gift shop, where small electrical appliances have an important spot. This gift shop has been maintained for some time, having been established primarily to attract floor traffic that could be profitably diverted to the electric fixture department, which was known as one of the most complete in the city until shortages and priorities clamped down. Now that the dealer must look for volume beyond contract wiring and electrical fixtures, the gift department has assumed new importance.

F. C. Bragg, owner, reports that the department actually does make enough profit to pay the rent on the store and take care of much of the overhead. It also maintains floor traffic and keeps the dealer in touch with customers whom he cannot serve immediately with electric wiring.

Under the management of Mrs. Bragg, the gift department has developed a long list of regular customers. One of the display win-

Aufford-Kelly Co., Inc., of Miami, had to start their appliance service business promotion from "scratch" since they had formerly concentrated all of their efforts on merchandising. This message, on the back of a penny postcard, has been helpful in bringing in service calls.

The gift department of the Electric Construction Co., of Little Rock, Arkansas, was established as a means of building up floor traffic for the electrical appliance and fixture department but today the gift line is proving to be the firm's most profitable. Shown here is Mrs. F. C. Bragg in one corner of the picture section.

dows is used continuously for gifts and for the handsomest electrical fixtures in stock. A very beautiful antique mantel, taken from an old home, is the center of interest in the window. So many people came into the store and sought to buy the mantel that Mr. Bragg installed eight others in the store. These mantels, usually taken from old homes that are being remodelled or torn down for defense construction, appeal to lovers of antiques. When one is sold, another is soon found to take its place.

Up until wiring materials became scarce, the mantels played an important part in making people want new fixtures and wiring, because each of them is equipped with handsome side brackets, candles, and other fixtures.

One of these mantels, placed in the picture section of the gift department, is used to display fireplace gadgets — andirons, tongs, pokers, screens, etc. This picture department is quite profitable, and is visited by people moving into new homes as well as by those seeking gifts.

A greeting card display shows its samples covered with cellophane. The stock is kept in files behind the counter.

Among the popular items which are not too difficult to secure at this time are colored glassware, ranging in price from 98 cents to $2.98, woodenware and lamps. Perfumes are another popular item.

* * *

Paints as a sideline are proving profitable for O. C. Wakenight, one of the oldest refrigerator dealers in Arkansas, who operates O. C. Wakenight Company, at Searcy. Wakenight had built up a profitable appliance business by cultivating 700 regular customers, many of whom had bought their second and third electrical refrigerator from him. Paints were added primarily to keep these regular customers.

"A lot of my customers who cannot get delivery on the appliance they want now," he added, "will still continue on our active customer list because we can now recondition their homes with paints. To my way of thinking, paints are a logical sideline for the electrical dealer. They are profitable in their own right, open many a lead for new contacts, have unusually attractive display possibilities, and go a long way toward making small inventories appear complete."

Mr. Wakenight believes in selecting one good brand of paint and selling the complete line. The brand he selected is bolstered with unusually attractive dealer helps. The unique style book is a magnet for practically every woman customer. The kitchen pages are helping to build up a long prospect list for the future, when appliances will be obtainable without restrictions.

Mr. Wakenight said that when a woman wants something new for the home, paints satisfy the longing temporarily. He said that he will continue to handle paints

O. C. Wakenight, of Searcy, Ark., recommends paint as a profitable side line for the appliance dealer. Among his reasons are the fact that it can be attractively displayed, a full line can be carried without requiring too much capital investment, it can be sold particularly to women and lead to many kitchen modernization prospects that can be sold when appliances are again available.

even after times become normal again.

He commenced his paint department with an elaborate open house, backed with extensive advertising including newspaper, direct mail, and radio. In the months that have followed he has had several special promotions, including a couple of painting schools.

* * *

Ben Duffie has been known as one of the leading electric refrigerator, attic ventilating and appliance dealers in Houston, Texas, for twenty years. He has been almost equally well known for his hobby—gardening, as he has been president of the Houston Men's Garden Club and a member of several garden clubs. Mrs. Ben Duffie, too, has been interested in garden club work—both of them have taken a number of prizes at Houston flower shows.

Ben Duffie operates two appliance stores in Houston, one at 1015 Westheimer and the other at 6640 Harrisburg. After Pearl Harbor, Dealer Duffie looked about for some field to supplement his restricted stocks of electric fans, refrigerators, appliances, gas ranges, etc. His hobby suggested one field for expansion.

At the main store, Mr. Duffie has installed a garden shop to supplement his electrical appliances and ranges. He has stocked

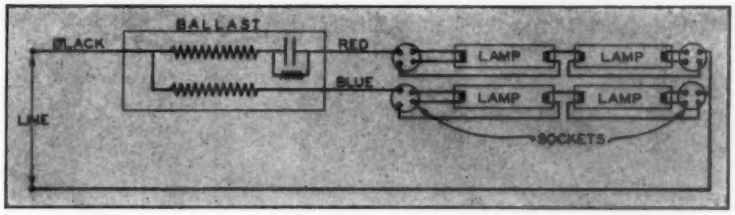
(*Continued on page 52*)

New Fluorescent Circuit Saves Critical War Metals

Development of a new circuit for fluorescent lighting fixtures and a specially designed ballast control unit — a system which makes possible a saving of millions of pounds of critical metals and also improves lighting efficiency — was announced recently by General Electric Lamp Department at Nela Park.

Basic idea of the new "sequence-starting circuit," covered by U. S. Patent No. 2,266,619, was conceived and developed by J. H. Campbell, a young G. E. lighting engineer, to whom the patent was issued.

The new fluorescent circuit permits the use of only one ballast—or control unit—with four 100-watt Mazda fluorescent lamps in place of the present 100-watt fluorescent fixtures which require two ballasts for four lamps. After the patent was issued to Mr. Campbell, he took the idea to the ballast technicians at General Electric's Fort Wayne plant, who designed the special split-phase fluorescent ballast necessary for the circuit. This new ballast is covered by U. S. Patent Nos. 2,056,629 and 2,025,471, held by General Electric.



This view shows how the four G.E. Mazda 100-watt fluorescent lamps are positioned in fixtures soon to be made available. The single specially designed ballast control unit held here by Nela lighting engineer J. H. Campbell must be mounted on the fixture and be properly connected electrically. The ballast unit weighs about 17 pounds. Heretofore, two ballasts weighing approximately 29 pounds would have been required. The schematic diagram shows how the lamps and ballast are connected.

The two lamps on each phase of the new circuit start in sequence and operate in series. Thus, one ballast does the work of two, effecting important economies in any fluorescent installation where the new circuit can be used. Although it is designed for use only with 100-watt fluorescent lamps and on 254, 265, and 277 volt circuits, many of the new war industry plants have this voltage available and other plants now being converted to war work can be changed over to take advantage of this circuit.

When questioned about the advantages of this new development, Mr. Campbell summed them up as follows:

1. A saving of nearly 50% on critical materials used for ballast equipment.
2. A 50% reduction in ballast cost.
3. An overall reduction in fixture cost of approximately 20%.
4. An 8% increase in light output per watt of current consumed.
5. A marked reduction in the weight of fixtures.

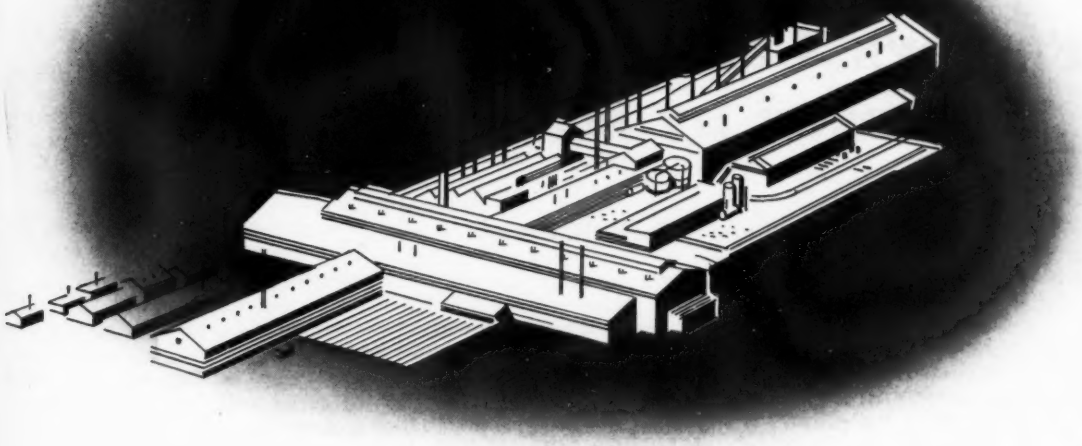
The new circuit and ballast carry certification by Electrical Testing Laboratories, Incorporated, New York City.

While the increase in efficiency in producing fluorescent lighting to speed war-time production can not be overlooked, the saving of critical materials by this new circuit is of major interest at present. For instance, in one large airplane plant where fixtures using the new hook-up are under consideration and in which more than 35,000 100-watt fluorescent lamps will be installed, engineers estimate that 23,275 pounds of copper, 80,960 pounds of iron and steel, and 3,250 pounds of aluminum will be saved. The overall saving in the weight of the ballast equipment totals about 132,000 pounds and a total of 303 kilowatts of current would be released for other war uses.

In fact, it is estimated that in new war plants under construction, where these fixtures could be installed, a potential saving for the last six months of 1942 amounts to 500,000 pounds of copper, 1,750,000 pounds of iron and steel, and 70,000 pounds of aluminum.

one
WESTINGHOUSE
Westinghouse

"fits" your Factory



CHOOSE THE POWER DISTRIBUTION SYSTEM THAT MEETS ALL OF YOUR REQUIREMENTS

It's easy to select the right plant distribution system. There are many different types available from which to make your selection. The important job is to choose the system that meets your plant's individual requirements. Only then can you be sure of maximum results, both from the standpoint of economy and efficiency.

Investigate carefully before you install. Regardless of the size, shape or type of factory you'll find an established distribution system that will service your load requirements.

Westinghouse can supply equipment for all of the different systems, including the new Plant Network System which has been adopted by nearly 40 new, large war factories.

All systems recommended by Westinghouse are designed for use with standard distribution equipment. No matter which system you select there will be no need to build special apparatus.

To help you select the system that fits your plant, Westinghouse has prepared a special book in which the advantages and applications of a group of different systems are briefly described. Just fill in and mail the coupon for your copy.

If you want faster action, phone our nearest office and ask one of our engineers to call and discuss your distribution problem. You will get immediate co-operation.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

PLANT DISTRIBUTION SYSTEMS

Factors Causing Meter Failure Disclosed by REA Experience

By F. B. Scott*

AT THE PRESENT time there are over a million watthour meters installed on REA-financed rural distribution systems in 45 states of the union, Alaska, and the Virgin Islands. A survey and analysis of the performance of these watthour meters will go a long way in deciding the proper methods of installation in rural areas throughout the United States. Performance data have been collected during 1941 involving 715,003 metering installations. The large majority of these installations use socket-type watthour meters installed on yard poles or on the side of buildings, the small balance being composed of indoor installations of bottom-feed type watthour meters.

Outdoor installation of socket-type watthour meters was the standard REA installation until the year of 1940. During that year a change was made and some 50,000 indoor installations have been made combining the meter with the service equipment. These indoor installations were made only on new systems, while extensions to older systems continued to use the outdoor type installation in most cases. This change in recommendations was made because of the following conditions:

(1) Field reports indicated a large number of meter failures due to lightning, moisture, and general outdoor exposure.

(2) The consumers on a majority of the systems were reading their own meters and mailing the readings to the system office and therefore an indoor installation would be a convenience for them.

(3) The systems were furnishing consumers with service equipment so that proper coordination with the distribution line and transformer protective devices could be maintained and this service equipment must necessarily be installed indoors.

Watthour meters of five manufacturers are included in this survey, four of whom you are all familiar with and a newcomer, the Stewart-Warner Corporation, who started to furnish meters to REA financed systems in 1940. There are approximately 25,000 of the new make of meter included in this survey, the balance being fairly equally divided between the other four makes.

Pictured here is a complete meter and service equipment combination of a type furnished to consumers on some REA systems as a part of the original installation. The unit consists of a Type A bottom-feed meter, with cyclometer register, and magnetic circuit-breaker equipment.

The use of the word "failure" does not mean that all of the meters were a total loss. A "failure" may consist of punctured potential coil, punctured current coil, weakened magnets, mechanical damage or any failure that required a service call.

Reports received indicate that the total amount of meter failures amounted to 5.1% per annum of the meters installed. Of this amount only .5% were reported to be totally destroyed, half of them by fire when the metering equipment burned with the buildings. The balance of those totally destroyed was divided among lightning, overload, mechanical injury, and freak accidents caused by almost anything from theft to tornadoes. These figures indicate that the number of meters which were totally destroyed due to electrical or mechanical reasons is very small and no large production of failures can be accomplished in this group.

Defective material was reported to be responsible for the failure of 2.16% per annum. This high percentage was due almost entirely to the development of satisfactory cyclometer-type registers for all makes of meters. In all cases, registers that were defective in design or operation have been replaced by the manufacturers without charge and systems were reimbursed for labor costs involved in the replacements. At the present time all design difficulties would seem to have been overcome. The large majority of defective registers have been re-

*Mr. Scott is head of Testing and Metering Unit, Technical Standards Division, Rural Electrification Administration

placed and no further serious future trouble of this sort is anticipated. Therefore, failures due to defective material may be expected to be very small from now on.

Lightning caused the next highest percentage of failures, being 1.72% per annum. You will be interested in knowing that this percentage was very high in the southeastern states of Florida, Georgia, Alabama, and South Carolina, being slightly over 5% per annum. These states are in an area of high lightning intensity which accounts for this high percentage of failures.

It is evident that high ground resistances contribute greatly to many of the meter failures due to lightning. It was found in the past from equipment failure reports that many systems do not have the proper ground resistance testing equipment and therefore have little idea as to the condition of their grounds. Also after a piece of equipment has failed due to lighting very few ever investigate the grounding even when they have the necessary instruments.

In summarizing the points brought up in this discussion, it must be emphasized that the data which have so far been collected are not complete enough to make definite recommendations, but a preliminary analysis gives fairly definite indications as to the factors that are involved in causing meter failures. Using these indications as a guide, an attempt will be made to collect sufficient pertinent data in another survey to establish more definite recommendations for the best type of meter installation for every region in the United States.

A summary of the recent survey shows the following fairly definite indications:

(1) It will not be possible to recommend one standard metering installation for all regions of the United States.

(2) A definite reduction in the damage due to lightning can be made by proper metering installations and proper grounding of the meter and service equipment.

(3) Steps should be taken to check all grounding resistances and to collect enough data on these resistances to be able to prepare an isometric chart of the United States showing grounding conditions.

(4) The use of secondary lightning arresters is not justified in many cases because, unless the ground resistance is low, they do not operate effectively, and, when the ground resistance is low, they are not needed.

(5) An outdoor socket-type meter installation is not satisfactory in some sections of the country where there is high lightning intensity or where the ambient temperature range is extremely wide, unless some additional protection is provided.

No attempt is made here to present a complete analysis of the survey, only the highlights are presented with a minimum of figures. The simple tabulation which follows is, however, quite interesting.

Meter Failures per Annum Reported by 630 REA Systems

Lightning	1.72%
Moisture	0.16%
Defective Material	2.16%
Overloads	0.04%
Fire	0.32%
Other	0.70%
Total	5.10%

The variation in these percentages in the ten regions into which REA systems are segregated shows clearly that certain types of failures are more prevalent in some regions than in others.

Following is an outline of the present methods of meter installations on REA-financed systems:

(1) Yard Pole Installations: (a) Socket-type meter and socket; (b) Type "A" meter and meter enclosure.

(2) Indoor Installations: (a) Socket-type meter and socket base containing from two to six circuit breakers; (b) Type "A" meter and meter base containing from two to six circuit breakers.

(3) Indoor-Outdoor Installation: (a) Socket-type meter and socket installed on outside of building, service center installed indoors with two to six circuit breakers; (b) Type "A" meter and meter enclosure installed on outside of the building, service center installed indoors with two to six circuit breakers.

All meter installations are grounded at the service head, the ground going from the neutral wire directly to a driven ground. The neutral wire of the service entrance cable is also connected at this point. With this method, any current discharge due to lightning surges does not pass through the meter enclosure.

The circuit breakers used are of the magnetic or thermal-magnetic type designed with definite time-current characteristics to insure coordination with the secondary protection at the transformers. The value of such coordination can be appreciated when it is realized that a service call to replace a transformer fuse may mean a trip of 30 to 40 miles.

Emergency Overloading Of Power Transformers

TAKING advantage of the maximum overload capacity of power transformers will provide additional electric power and take care of emergency conditions caused by electrical failure or sabotage.

This suggestion for getting the most out of existing power transformer equipment was made in a paper by V. M. Montsinger and P. M. Ketchum, of the General Electric Company, presented June 24 at the Summer Convention of the American Institute of Electrical Engineers, meeting in Chicago. They recommended that the problem of preparing emergency overloads be given immediate consideration by the AIEE Transformer Subcommittee of the Electrical Machinery Committee.

Emergency overloads considerably in excess of those given in the American Standards Association Guides for operation were found possible, based upon data obtained in the laboratory on the aging of insulation, and by use of the rule that for each eight degrees Centigrade (14.4 F.) the temperature is increased, the life of the transformer is halved.

The authors pointed out that while the practice of overloading transformers has been increasing during the past few years, the importance of taking advantage of maximum overload capacity is greater today than ever before. There are two reasons, they said:

"First, in many cases the demand for additional electric power has caught up with or even exceeded the present transformer capacity—when operated in the usual manner—and additional capacity is needed. A great many loading curves show that the load factor of most power transformers ranges from 50 to 65 per cent. A

large reservoir of capacity is therefore available which could be used without causing a serious shortening of transformer life.

"Second, we now have the important problem of taking care of rare emergency conditions caused either by electrical failure or by a saboteur. In the past it has generally been considered necessary to carry a spare transformer or a spare bank of transformers to pick up the load in case of a failure. Today many users are considering the use of, and are relying on, the short-time overload capacity of their transformers to carry them through rare emergency conditions. In fact, under some conditions it may be economical and necessary to use up 25 per cent, 50 per cent, or more of the transformer life to prevent a shutdown."

To do this intelligently requires reliable information on how to calculate hot-spot temperature, and how the life of the transformer is affected by heavy over-loads. The Montsinger-Ketchum paper was devoted to a discussion of that problem.

The authors reported that approximately 50 heat runs were made during the past year on three transformers of different ratings. These heat runs provided accurate data on: (1) the value of the hot-spot temperature in various classes of transformers at rated load, and (2) a practical method of calculating the hot-spot temperature with changes in the load under both ultimate and short-time overload conditions.

The rate of deterioration of insulation in a transformer is governed by the hot-spot temperature in the winding, they said, although quite often factors other than the life of the insulation limit heavy overloads for transformers. Among such factors are contacts, leads, joints, and oil. Effect of heavy overloads on regulation must also be carefully considered.

The following general conclusions on steady state and transient temperature rises were presented:

1. For rated load conditions of self-cooled power transformers, the hot-spot rise over average winding temperature by resistance ranges from approximately 5° C. upward. For moderate size and voltage rating (below approximately 50 kv) it naturally comes between 5 and 6 degrees.

2. For transformers having an OAP rating 1.33 times the self-cooled rating, the hot-spot rise over average winding temperature is approximately 40 per cent greater than that for the self-cooled rating.

3. The hot-spot rise over average winding temperature increases with load (for both ultimate and short-time overloads) but no definite rate of rise versus load can be stated.

4. The average winding rise over average oil varies as the loss raised to a power ranging from 0.6 to 0.7.

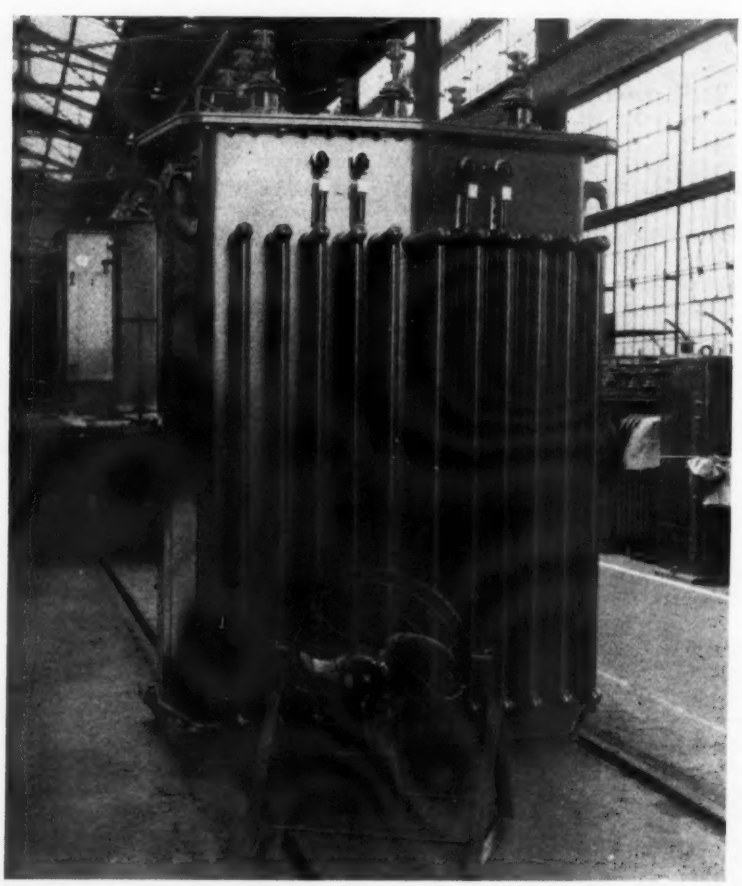
5. The hot-spot rise over top oil varies as the loss raised to a power ranging from approximately 0.7 to 0.8, generally more nearly the 0.8 power for most transformers.

6. The oil time constant used in calculating the temperature rise of the oil for short-time overloads should be based on the ultimate rise and loss for rated load conditions.

7. The winding time constant used in calculating the temperature rise of winding over oil before conditions become constant, should be based on the calculated ultimate rise and loss for the load under consideration.

8. Either loading-back or short-circuit method of loading can be used to determine both hot-spot and average winding temperatures. When calculating the transient oil rises by equation, for the short-circuit method, the weight of the core should not be used in deriving the time constant.

9. The temperature rise of both the average and top oil varies approximately as the 0.8 power of the loss for ultimate conditions.



The application of portable air blast units for supplying auxiliary cooling air to self-cooled power transformers will permit increases in the rated capacity of such transformers up to 25 to 33 per cent. The number of fans required varies with the size of the transformer. The fan illustrated here, especially designed for the purpose, delivers approximately 2100 cfm. It is driven by a 1/12 horsepower, 3-phase, 220-volt motor. (Westinghouse photo.)

NEWS of the INDUSTRY
National and Southern

45,000 Electric Ranges Released for Sale

Some 45,000 electric ranges, frozen since May 2, 1942, in the hands of dealers, distributors and manufacturers, are released for sale to the public upon certification as to need by an amendment to Supplementary Limitation Order L-23-b issued recently by the Director General for Operations of the War Production Board.

The amendment No. 1 releases all electric ranges in the hands of dealers as well as ranges having a factory sales value of $80 and over in the hands of distributors and manufacturers. Ranges having a factory sales value of less than $80 in the hands of distributors and manufacturers are not released but must be held for defense housing or war agencies.

To qualify for a new electric range, a person must certify to the dealer in writing either: (a) that a new domestic electric range is required to replace one that is worn-out, damaged beyond repair, or destroyed; or (b) that no other cooking equipment is available, that the premises are wired for the installation of a range, and that electric facilities for range operation are installed.

Ranges may also be used to fill orders for the Army, Navy, Maritime Commission or the War Shipping Administration, but it is believed that few if any of the ranges will be needed for such purposes, inasmuch as such agencies use commercial types not affected by the order.

Orders bearing a preference rating of A-9 or higher granted prior to July 16, 1942, may be filled, but no additional preference ratings will be granted to consumers in view of the certification method established by this amendment for consumer purchase of electric ranges.

The WPB Consumers' Durable Goods Branch estimates that approximately 70,000 electric ranges are now in the hands of dealers, distributors and manufacturers. Since production has ceased, that represents the total stock available for the duration of the war. Of that number, about 25,000 will be held for defense houses; the remaining 45,000 will be made available to the public under conditions already stated, as a result of the unfreeze order.

Last year approximately 500,000 electric ranges were manufactured, or about 100,000 above normal production. Thus, the 45,000 ranges being released to the public represent normally a little more than a month's supply. However, because of the restrictions placed on their sales, it is expected that the supply will last about six months. After that the public will have to depend on electric ranges in homes and on ranges heated by other fuels to meet their needs.

Exchange Section Heads Announced

L. P. Sweat, vice-president of Mississippi Power Company, Gulfport, and president of the Southeastern Electric Exchange, has announced the following appointments of section chairmen to direct the sectional activities of the Southeastern Electric Exchange during the forthcoming administrative year:

J. D. Stietenroth, treasurer, Mississippi Power and Light Company, Jackson, has been reappointed chairman of the Accounting Section.

Wells M. Stanley, vice-president, Alabama Power Company, Birmingham, has been reappointed chairman of the Sales Section.

P. J. Carlin, superintendent of distribution, Florida Power and Light Company, Miami, will head the Engineering and Operation Section, succeeding Lewis Payne, president, Eastern Shore Public Service Co.

T. Norman Jones, vice-president, Virginia Electric & Power Company, Richmond, Va., has been appointed chairman of the Employee Activities Committee, succeeding J. M. Stafford, Jr., Georgia Power Company.

Carboloy Tool Production Capacity Increased

With Carboloy standard tools now continuously available for delivery directly from stock in virtually all sizes, Carboloy Company, Inc., Detroit, has announced a further increase in manufacturing facilities.

Intended to increase reserve capacity for standard tool production, the tool department of a General Electric subsidiary in the Illinois region, formerly manufacturing appliances, has been equipped to produce such tools from carbide materials furnished under sub-contract.

Wells M. Stanley | P. J. Carlin | J. D. Stietenroth | T. Norman Jones

Utility Employees in Scrap Rubber Drive

Evidence that employee organizations of utility companies can play an important part in salvage, bond sale, and other such campaigns, which require the active support and cooperation of thousands of individuals, is to be found in recent activities of southern electric power companies.

An outstanding example is the scrap rubber drive conducted by the employees of Durham Public Service Company, of Durham, N. C. Headed by Lee C. Goodwin, new business manager, the employees of the Durham utility accomplished the amazing feat of collecting 1,800 times as much scrap rubber as company officials estimated could be collected. In the three-week period of the contest, more than 60,000 pounds of scrap were collected and turned in to the rubber collecting agencies.

The company drive was part of a program sponsored by the Cities Service Power & Light Company among subsidiary companies. R. L. Lindsey, vice-president and general manager, announced the drive, in the form of a contest, to all employees of the Durham company. Prizes of war bonds and war savings stamps were offered to employees turning in the largest quantity of scrap. Although a quota of only 3,360 pounds had been set, the drive brought in an average of 269 pounds per employee, for the total of 224 employees. First and second prize winners were P. L. Hicks and G. H. Campbell.

* * *

Members of the Louisiana Power and Light Company engineering and construction departments constructed from the junk pile two sets of 46-kilovolt disconnect switches urgently needed for extension to an army camp. It was a rush job and even with the good priority rating the company could not have had them delivered on time.

Twelve non-standard 69-kv insulators from old cell type arresters installed in 1925 and discarded several years ago, were used along with other old obsolete and damaged material. The switches were not streamlined but company engineers said they would do the job both eletrically and mechanically.

* * *

Thomas W. Martin, president of Alabama Power Company, announced on July 2nd that orders had been given for the removal of rubber mats from trunks of all cars owned and operated by the company throughout its entire system. He said there were approximately 175 such cars and while he was unable to give an accurate estimate of how much this might amount to, he was sure it would be an appreciable amount.

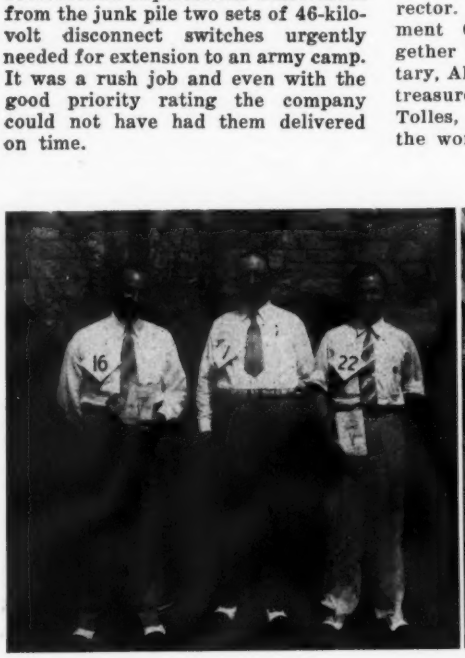
"We have also," said Mr. Martin, "gathered something over 1,500 pounds of old rubber tile flooring, rubber mats, etc., from the general office building in Birmingham."

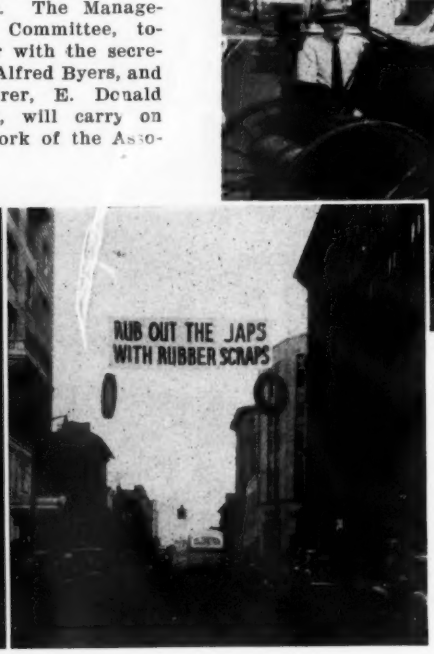
Mr. Martin said this effort was in addition to regular plant salvage operations in all plants of the company and was done in aid of the President's scrap rubber campaign.

NEWA Will Select New Managing Director

At a meeting of the Management Committee of National Electrical Wholesalers Association, held at New York on July 1, 1942, at which all members of the committee were present, it was announced that W. J. Parker had resigned as acting managing director. The Management Committee, together with the secretary, Alfred Byers, and treasurer, E. Donald Tolles, will carry on the work of the Association. Meanwhile, the Management Committee is considering the selection of a new managing director, according to announcement by D. Lyle Fife, president.

William M. (Bill) Shepherd, rural development director of the Arkansas Power and Light Company, was unanimously elected president of the United States Chamber of Commerce at the annual convention held in Dallas, Tex., in June. He is shown, above, at left, receiving congratulations and the gavel from Walter Finke, of Minneapolis, Minn., the retiring president. Herbert Hayes, of Atlanta, new national vice-president, admires the proceedings from under a 10-gallon convention sombrero.





Above and at left are typical ballyhoo stunts staged by the employees of Durham Public Service Co. in their recent rubber salvage campaign and contest. At far left, winners in the contest, P. L. Hicks and G. H. Campbell stand with R. L. Lindsey (center) general manager.

168-HOUR WEEK FOR POWER AND LIGHT

Outmoded wiring systems can't stand today's wartime pace! Only modern bus duct meets the needs of round-the-clock operation . . . quick production changes . . . low installation and maintenance costs

America is winning—but has not yet won — its race against time.

Shipping platforms tell an encouraging story of war production, but the progress of the job must still be measured in terms of time.

Round-the-clock, round-the-calendar operation of machine tools calls for an electrical system that will stay on duty a *full* 168 hours *every* week. War plants can't afford to gamble on a single "if."

BullDog has designed its flexible power and lighting systems with every wartime consideration in mind — *efficiency* of operation, *speed* of conversion, *economy* of critical materials, *protection* against breakdown and sabotage, *saving* of installation time, *safety, cost* of maintenance.

Power and Light "Stripped for Action"

Who is to say which of these advantages is most important? It is our belief that *all* are *vital*, if industry is to reach its victory production goal.

It was because old-fashioned wiring methods could not meet the requirements of modern manufacture that BullDog pioneered the first bus duct systems many years ago. They are engineered for mass production and built by mass production methods.

The same needs that made these systems standard in normal times have made them doubly valuable in this emergency. *An hour saved today may well be worth a month in '43.*

These, in brief, are BullDog's chief advantages

Power and light *where* they are needed, *when* they are needed.

System can be installed in new plants without waiting for machine layout . . . and machines can go to work as soon as the roof is on.

Tool set-ups can be changed, machines moved, without interrupting light or power.

Power operates at higher efficiency, with less voltage loss, than in any other system.

An enclosed system, protected against breakdowns, sabotage and short circuits.

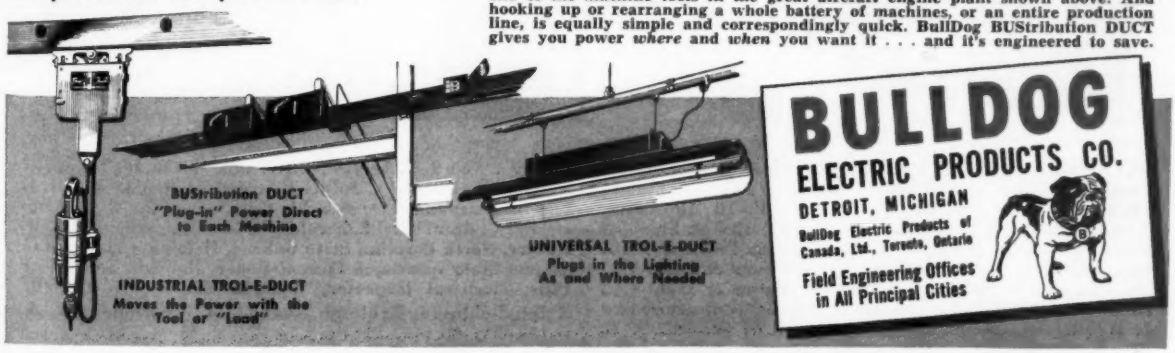
System is engineered for maximum efficient use of war-scarce materials. No rubber needed. Valuable aluminum saved for other indispensable war uses.

Installation in a fraction of the time required for old-fashioned wiring.

Standard, interchangeable sections—100% salvable. Instantly convertible from one production set-up to another.

BullDog "Plug-in" Power Is an Integral Part of the Machine Tools It Serves

"Just a ten-minute job!" That's all the time it takes to hook up the power for any one of the machine tools in the great aircraft engine plant shown above. And hooking up or rearranging a whole battery of machines, or an entire production line, is equally simple and correspondingly quick. BullDog BUStribution DUCT gives you power *where* and *when* you want it . . . and it's engineered to save.


BUStribution DUCT
"Plug-in" Power Direct to Each Machine
INDUSTRIAL TROL-E-DUCT
Moves the Power with the Tool or "Load"
UNIVERSAL TROL-E-DUCT
Plugs in the Lighting As and Where Needed
BULLDOG
ELECTRIC PRODUCTS CO.
DETROIT, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

BULLDOG "PLUG-IN" SYSTEMS—THE ARTERIES THAT SUPPLY POWER AND LIGHT FOR WAR PRODUCTION

WAR-TIME PROBLEMS DISCUSSED AT N. C. ELECTRIC INSTITUTE

"ELECTRICITY in the War Program" was the theme of a two-day meeting held at the North Carolina State College in Raleigh on July 14-15. Sponsored by the North Carolina Chapter of the I.A.E.I., the N. C. Association of Electrical Contractors, and the State Board of Examiners of Electrical Contractors, as well as the State College, the meeting attracted an attendance of nearly one hundred persons, including inspectors, contractors, utility personnel, and manufacturers representatives. N. E. Cannady, State Electrical Engineer and Inspector, and C. S. Whitaker, chief electrical inspector of Durham, presided over the sessions.

Victor H. Tousley, International Secretary, I.A.E.I., brought word to the meeting that there would be no 1943 edition of the National Electrical Code, nor a meeting of the Electrical Committee, of NFPA, this year. He explained that the Electrical Committee was about to approve the formation of a small committee with power to act on Code changes that may be made desirable by war-time conditions. According to Mr. Tousley, the 1940 Code will remain in effect but a supplement will be issued soon including all interim amendments.

Among the changes that will be recognized are the use of CNX cable for certain types of installations; weather-proof and slow burning insulated wires for use on neutrals; deletion of Section 2452, making use of non-tamperable fuses mandatory, for the duration of the war; and recognition of varnish cambric insulation for current carrying capacities of either 1937 or 1940 Code — whichever is higher.

Mr. Tousley outlined some of the changes in wiring that could be expected in the very near future; iron wiring for residences; open wires on a running board suspended from straps; second-hand wire refinished for new use. He directed attention to a new ruling that prohibited use of copper wire for grounding electrical equipment.

One of the most inspiring talks presented at the Institute was that of S. Paul Vecker, vice-president, Carolina Power & Light Co., whose subject was "Serving Civilian Needs During the Emergency."

Left to right: (1) W. B. Stover, Duke Power Co., Charlotte; Charles M. Stone, also of Duke Power Co., and L. P. Spoon, Thomas & Betts Co., New York. (2) E. H. Alexander, General Electric Co., Schenectady, and Charles M. Stone of Duke Power Co. (3) B. D. Kelly, Carolina Power & Light Co., Asheville; E. B. Hicks, Carolina Power & Light Co., Raleigh, and R. W. Talton, Carolina Power & Light Co., Henderson, N. C. (4) Thomas J. Taylor, contractor, and J. M. Blalock, electrical inspector, both of Oxford, N. C. (5) V. H. Tousley, International secretary, I.A.E.I., Chicago; E. G. Romeiser, Porcelain Insulated Wiring Systems, Union City, Ind., and J. S. Mahan, Fustat Manufacturers, Chicago. (6) S. P. Vecker, of Raleigh, and R. W. Talton, of Henderson, both of Carolina Power & Light Co. (7) S. J. Rosch, Anaconda Wire & Cable Co., New York; W. E. Armstrong, Underwriters' Laboratories, Inc., Chicago; and L. M. Keever, North Carolina State College, Raleigh. (8) Dan C. Boney, State Insurance Commissioner, Raleigh, and Henry Pitts, electrical inspector, Roanoke Rapids, N. C. (9) Ralph Robinson, Robinson Electric Co., Charlotte; Roy A. Palmer, Duke Power Co., Charlotte; S. M. Ayers, electrical inspector, Boone, N. C.; and J. L. Speights, Virginia Electric and Power Company, Richmond.

HOME LAUNDRY TRAINING WEEK!

SECOND OF NATIONAL SERIES

General Electric appliance training schools have already won the enthusiastic support of dealers and service men from coast to coast. More than 3000 recently took refrigerator service training in approximately 100 schools across the country. Now comes the second national series of schools, concentrating on G-E Home Laundry equipment, including washers and ironers.

BEGINNING AUGUST 24th

Some time from the latter part of August on there will be a G-E Home Laundry Service Training School in session near you. A partial list of dates and locations are shown in the box.

SOME OF THE FEATURES

1. Sensational new G-E Movie: "Into the Wringer and Out—with J. Smedley Sprout." 2. Sound slide film: "Servicing Washer Mechanisms and Wringers." 3. Another movie (tentative): "Eight Months Later," brings you up to date on G.E.'s service policy and program. 4. "Round Robin," session on washer and ironer servicing, supervised by G-E trained service personnel.

SEE YOUR G-E DISTRIBUTOR

Home Laundry Training Schools in your locality are sponsored by your General Electric appliance distributor. Be sure to get in touch with him *now* for actual dates and other information. All dealers and service men interested in G-E washer and ironer servicing are cordially invited to attend. Some time will also be devoted to service problems on other appliances.

★ ★ ★

GENERAL ELECTRIC and its distributors have a three-fold aim in setting up these national service training schools . . . 1. To help back up the Government's Conservation Program. 2. To help Mrs. America get the most out of her appliances for the duration. 3. To assist G-E appliance dealers in performing a better servicing job and thus help them build a more successful business.

Already more than 1000 dealers have qualified through our distributors as authorized Appliance Service Center dealers for G-E appliances. Get all the facts on how you, too, can qualify, by attending one of the Home Laundry Training Schools your G-E distributor is going to conduct. Consult him TODAY!

ENROLL NOW IN ONE OF THESE HOME LAUNDRY TRAINING MEETINGS!

NORTHEASTERN DIST.

Utica, New York	Aug. 17
Albany, New York	Aug. 18
New Bedford, Mass.	Aug. 20
Providence, R. I.	Aug. 21
Boston, Mass.	Aug. 25
Hartford, Conn.	Aug. 26
Worcester, Mass.	Aug. 27

METROPOLITAN DIST.

N. Y. City (2 schools)	Aug. 25
New York City	Sept. 15
Newark, N. J.	Aug. 27

ATLANTIC DISTRICT

Williamsport, Pa.	September
Clearfield, Pa.	September
Reading, Pa.	Sept. 14
Wilkes-Barre, Pa.	Sept. 16
Allentown, Pa.	Sept. 18
Lancaster, Pa.	Aug. 25
Harrisburg, Pa.	Aug. 26
Philadelphia, Pa.	Sept. 15
Atlantic City, N. J.	Sept. 22
Wilmington, Del.	Aug. 25
Baltimore, Md.	Aug. 26
Washington, D. C.	Aug. 27
Luray, Va.	September
Hagerstown, Md.	September

SOUTHEASTERN DIST.

New Orleans, La.	Aug. 25
Jackson, Miss.	Aug. 26

EAST CENTRAL DIST.

Middlebore, Ky.	Aug. 24
Grand Rapids, Mich.	Aug. 25
Lexington, Ky.	Aug. 25
New Castle, Pa.	Aug. 25
Louisville, Ky.	Aug. 26
Pittsburgh, Pa.	Aug. 26
Columbus, Ohio	Aug. 27
Saginaw, Mich.	Aug. 27
Evansville, Ind.	Aug. 27
Canton, Ohio	Aug. 27
Cincinnati, Ohio	Aug. 28
Toledo, Ohio	Sept. 2
Fort Wayne, Ind.	Sept. 3
Cleveland, Ohio	not set

CENTRAL DISTRICT

Indianapolis, Ind.	Aug. 24
Muncie, Ind.	Aug. 25
Terre Haute, Ind.	Aug. 26
Chicago, Ill.	Aug. 27
Rockford, Ill.	Aug. 28
Peoria, Ill.	Aug. 31
South Bend, Ind.	Aug. 31
Urbana, Ill.	Sept. 1
Milwaukee, Wis.	Sept. 2
St. Louis, Mo.	Sept. 4

WEST CENTRAL DIST.

St. Paul, Minn.	Aug. 19
Minneapolis, Minn.	Aug. 20
La Crosse, Wisc.	Aug. 24
Mankato, Minn.	Aug. 25
Denver, Colo.	Aug. 27
Duluth, Minn.	Aug. 27
Brainerd, Minn.	Aug. 28
Burlington, Ia.	Aug. 31
Davenport, Ia.	Sept. 1
Dubuque, Ia.	Sept. 2
Waterloo, Ia.	Sept. 3
Mason City, Ia.	Sept. 4
Fargo, N. D.	Sept. 10
Sioux Falls, S. D.	Sept. 14
Sioux City, Ia.	Sept. 15
Omaha, Neb.	Sept. 17
Des Moines, Ia.	Sept. 18
Kansas City, Mo.	Sept. 21
Joplin, Mo.	Sept. 23
Wichita, Kansas	Sept. 25

SOUTHWESTERN DIST.

Oklahoma City, Okla.	Aug. 23
Wichita Falls, Texas	Aug. 24
Dallas, Texas	Aug. 25
Little Rock, Ark.	Aug. 26
Tyler, Texas	Aug. 26
Waco, Texas	Aug. 27
San Antonio, Texas	Aug. 28
Houston, Texas	Aug. 28
Beaumont, Texas	Aug. 29
Tulsa, Ariz.	Aug. 30

PACIFIC COAST DIST.

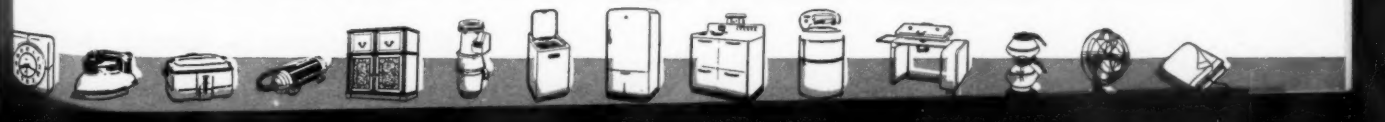
Bakersfield, Calif.	Aug. 24
Los Angeles, Calif.	Aug. 24
San Jose, Calif.	Aug. 24
Eugene, Ore.	Aug. 24
San Diego, Calif.	Aug. 25
San Francisco, Calif.	Aug. 25
Fresno, Calif.	Aug. 25
San Bernardino, Calif.	Aug. 26
Bellingham, Wash.	Aug. 26
Stockton, Calif.	Aug. 26
Portland, Ore.	Aug. 26
Seattle, Wash.	Aug. 27
Sacramento, Calif.	Aug. 27
Phoenix, Ariz.	Aug. 28
Olympia, Wash.	Aug. 28
Red Bluff, Calif.	Aug. 28

AUTHORIZED GENERAL ELECTRIC APPLIANCE SERVICE CENTER DEALER

This sign, identifying the G-E Authorized Service Center Dealer, will get wide-spread publicity. A full-color, 2-page advertisement featuring it will appear in the August 29th issue of the Saturday Evening Post, *which is on the newsstand August 25th. Other equally striking advertisements will appear in* Life, *August 24th;* Better Homes and Gardens, *September;* Ladies' Home Journal, *September; and* McCall's, *September.*

General Electric Co., Appliance and Merchandise Department, Bridgeport, Connecticut

GENERAL ELECTRIC



Left to right: (1) C. M. Jones, Underwriters' Laboratories, Inc., Atlanta; and J. L. Speights, Virginia Electric & Power Co., Richmond. (2) S. J. Rosch, Anaconda Wire & Cable Co., New York; Lee F. Adams, General Electric Co., Schenectady, and N. E. Cannady, N. C. State Electrical Engineer, Raleigh. (3) Adam S. Honeycutt, contractor, Oakborough, N. C.; and Ralph Robinson, Robinson Electric Co., Charlotte. (4) Bill Henry, National Electric Products Co., Charlotte; Wade Gallant, Westinghouse Elec. & Mfg. Co., Raleigh; and Paul Lyman, Carolina Power & Light Co., Raleigh. (5) R. E. Suggs, Durham County electrical inspector, and George John, electrical inspector, Camp Bolton, N. C. (6) E. V. Sapp, Economy Electric & Supply Co., Charlotte, and Dwight Casey, executive secretary of N. C. Electrical Contractors Association.

H. G. Knoderer, commercial engineer, General Electric Co., told the group of the value and importance of local meetings of the I.A.E.I.

Others who addressed the meeting included Lee Adams and E. H. Alexander, both of General Electric Co., who discussed the application of electrical control equipment; E. G. Romeiser, field engineer for Porcelain Insulated Wiring Systems, who discussed the savings in critical materials that could be realized through the use of porcelain for insulation; W. F. Armstrong, of Underwriters Laboratories, Inc., who outlined some of the substitution of materials necessitated by the war production program; Dwight L.Casey, secretary, N. C. Association of Electrical Contractors, who discussed contractor activities under present conditions; Arthur L. Abbott, of NEMA, who talked on "Emergency Requirements and Emergency Codes"; Sherwood Brockwell, state fire marshall, who talked on defense against incendiary bombs; Joseph J. Siddall, commercial engineer, H. H. Robertson Co., whose subject was "Cellular Metal Floor Raceways"; and L. M. Keever, associate professor of electrical engineering, N. C. State College, who described the contribution the college is making in aiding the war training program.

John Booth, district manager, Bussman Mfg. Co., Richmond, and J. S. Mahan, consultant, Fustat Manufacturers, Chicago, both were in attendance and answered questions on fuses.

Cooperation In War Effort Theme of IAEL Meeting

Activities designed to aid in the war effort—ranging from maintenance of appliances to salvage of critical materials—will be reviewed in detail by league managers and others attending the Seventh Annual Conference of the International Association of Electrical Leagues scheduled for September 17-19, 1942 at the Hotel Cleveland, Cleveland, Ohio.

Carl H. Christine, president, appointed a program committee consisting of J. S. Bartlett, Washington, D. C.; John A. Morrison, Philadelphia, Pa., and W. A. Ritt, Minneapolis, Minn., to prepare the program which will be devoted entirely to discussing topics related to the war effort.

Among the subjects scheduled, are servicing, maintaining and repairing appliances; the dealer situation; maintaining relations with builders, home financiers and their associations; handling of problems incident to dim-outs and blackouts; aiding in plans for power conservation; campaigns to salvage critical material; promoting safety lighting of access roads to industrial plants; aiding industrials to obtain needed electrical equipment; new approaches to present activities to make them more effective in the war situation; cooperating with local Chambers of Commerce and other groups, in the development of programs to get business back to a peace-time basis when the war is over.

There will be three general open sessions on September 17 and 18. Business affairs of the IAEL will be discussed on the afternoon of the 18th and the 19th will be devoted to a round-table forum on league management problems for managers of member organizations.

Guide to Wartime Care Of Electric Motors

Allis-Chalmers Manufacturing Company announces the publication of an entirely new kind of maintenance handbook — "A Guide to Wartime Care of Electric Motors." According to the company, the times demand a fresh approach to problems of motor care. Increase in the average motor's working time from 1800 to 8700 hours a year is cited.

Other new factors noted are the importance of continuous motor operation to the war effort, increasing difficulty of obtaining new motors, and the lack of previous experience with electric motors on the part of the thousands and thousands of new workers now being pressed into service in war production plants.

Unlike most maintenance books, "A Guide to Wartime Care of Electric Motors" applies to all makes of standard, general-purpose motors. It contains no advertising.

Fluorescent Lighting Manual Now Available

Answering a definite need for a complete and accurate treatise on science's latest contribution to lighting progress, a new book entitled "Fluorescent Lighting Manual"—by Charles L. Amick of General Electric's Nela Park Engineering Department, Cleveland—has just come off the press.

The new book of 312 pages, of easily readable type and couched in layman's language, charts a course midway between highly technical booklets on the subject and popular feature articles in the public prints, science and trade magazines.

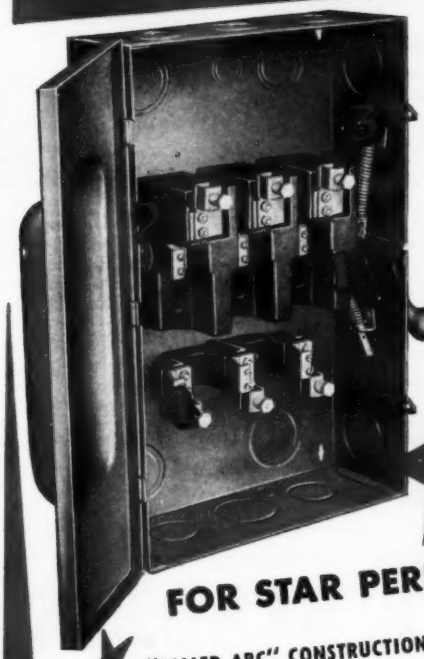
Profusely illustrated with halftones and diagramatic sketches, "Fluorescent Lighting Manual," published by McGraw-Hill Book Company, Inc., treats of such matters as: unique characteristics of fluorescent lamps; interprets the basic philosophy of illuminating engineering (with respect to footcandle standards and lighting quality) especially for the benefit of readers to whom lighting is a somewhat new and mysterious phenomenon.

C. L. Amick

The book is so written that nearly anyone, whether he has had much electrical background or not, can gain a wealth of interesting, practical information on fluorescent lighting from any of its ten chapters. Chief purpose of the manual, according to its author, is to provide a ready reference source for the fundamental knowledge useful in solving the problems which arise in contemporary fluorescent lighting practice.

The manual makes available a timely authoritative accounting of the construction and performance of all types of F-lamps. It reveals the principles and methods of calculating illuminating requirements and designing luminaires and installations. It includes helpful pointers on how to install the lamps themselves, how to assure maximum light output, and how to locate and remedy trouble, if any. Enlightening comparisons of economic factors concerning fluor-

FEDERAL
ELECTRIC PRODUCTS



Sealed Arc
SAFETY SWITCHES FOR INDUSTRY
Star features

FOR STAR PERFORMANCE

"SEALED ARC" CONSTRUCTION barricades switching arms behind porcelain to minimize effects of arcing, assure long life for contacts.

VERTICAL-RIBBED ARCING CHUTES, lining interior chamber of switching block, break up and snuff the arc. An exclusive Federal feature.

STURDY QUICK-MAKE, QUICK-BREAK spring mechanism.

PATENTED "VISE-CLAMPS" grip fuses tighter than old-fashioned spring tension, prevent heating.

These are but four of the many features that make Federal "Sealed Arc" Safety Switches favorites for every industrial application. Use them for trouble-free operation on your essential circuits.

For Complete Safety Switch Data
write for Bulletin 21-40-S. Contains all essential facts on Types A, C and D Federal "Sealed Arc" Safety Switches.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
60 PARIS STREET, NEWARK, N. J.

Follow the Federal Line

escent lighting vs. filament lamp lighting and that of other sources are provided in this manual. Price of the new "Fluorescent Lighting Manual" is $3.00.

Engineers Help Power Systems Increase Output

The nation's power systems are facing one of the most critical problems in their history in endeavoring to obtain increased output of electricity from existing facilities to meet ever-mounting war needs, Chas. F. Lloyd, manager of the Westinghouse Central Station Sales Department, disclosed in addressing a meeting of the Westinghouse Electric and Manufacturing Company's central station managers brought to Pittsburgh from every district in the nation for a symposium on war power problems.

Mr. Lloyd said: "Shortages of materials are making it increasingly difficult to manufacture new apparatus for supplying the electrical needs of our war industries. For that reason, it is our duty as manufacturers of electrical equipment to offer our engineering resources to the hard-pressed power companies. We must help them devise ways and means of squeezing every available kilowatt hour of electricity from present equipment."

Left to right, O. O. Rae, southeastern central station division manager, Atlanta; C. F. Wagner, manager of central station engineering department, East Pittsburgh; L. W. McLeod, southwestern central station division manager, St. Louis; and C. F. Lloyd, manager of central station sales department, East Pittsburgh, all of Westinghouse Electric & Mfg. Co.

Westinghouse design and application engineers are devoting a large percentage of their time to assisting the operators of electric power systems in solving this pressing war problem, reported Charles F. Wagner, manager of the Central Station Engineering Department.

"Working jointly with utility engineers, we have developed plans for the rebuilding of many old generators so that additional electric power can be added to the nation's supply without making heavy demands on critical materials," Mr. Wagner said, adding: "These same engineers by cooperative effort have produced auxiliary cooling equipment that enables transformers to carry additional loads. This eleminates in many cases the immediate necessity for new transformers."

Many of the nation's electric power systems have been set up in miniature on the Westinghouse electrical calculating board to find ways and means of getting more power out of existing systems.

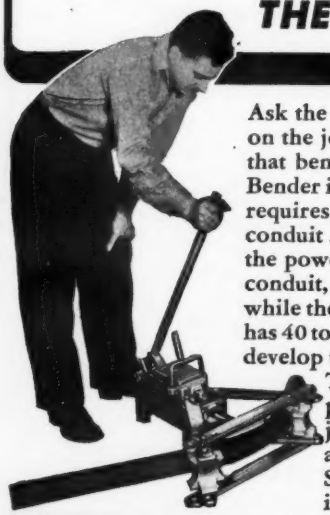
Also as an aid to war production, Westinghouse has set up a special organization to devote its entire time to handling vital repair and maintenance work for public utilities and manufacturing industries throughout the nation, Frank H. Stohr, manager of the Industry Sales Department, told the forum.

Utility Companies May Sell Excess Stocks

A utility company may sell materials from excess stocks or inventories to any other utility company or war production plants, provided the order for such materials carries a preference rating of A-5 or higher. This is provided for in Amendment No. 2 to P-46, announced recently by the War Production Board.

GREENLEE BENDERS

EASIER AND FASTER FOR THE MAN ON THE JOB



Ask the man who knows . . . the operator right out on the job doing the bending . . . and he'll tell you that bending conduit with the Greenlee Hydraulic Bender is even easier than it looks. To bend conduit requires power . . . approximately 31 tons for 4-inch conduit . . . and Greenlee Hydraulic Benders have the power. The No. 770 Bender, for 1¼ to 3-inch conduit, has 25 tons of easily developed power, while the No. 775 Bender, for 3 to 4½-inch conduit, has 40 tons of hydraulic power. One man can quickly develop this power by simply pumping the handles. These light, portable benders are built compactly into one unit, are easily carried to the jobs and set up, and will not move and twist about when in use. Our Bender Booklet S-116 will show you how you can cut bending costs on every job.

Greenlee No. 770 Bender

Send for BENDER BULLETIN S-116

GREENLEE TOOL CO.

1768 COLUMBIA AVE., ROCKFORD, ILL.

Industrial Engineers Survey South's Facilities

Engineers of member companies of the Southeastern Electric Exchange this month are completing surveys of the industrial facilities and resources in their territories with a view toward making greater use of Southeastern industrial plants for all-out war production.

The industrial survey grew out of a meeting between executives of the utilities and officials of the War Production Board in Atlanta on July 2. Sponsored by the SEE, the meeting was attended by approximately forty men.

It followed a similar meeting, held the week before, of WPB officials and engineers of the Georgia Power Company. The model program agreed upon at that meeting for a survey of Georgia's industrial facilities was adopted for use in other Southeastern states.

At the SEE meeting, O. M. Jackson, former sales promotion manager of the Georgia Power Company and now deputy regional director of the WPB, declared that "getting products out of the southeast for successful prosecution of the war effort is the single purpose of the WPB, which has been reorganized and staffed to provide the management of Southern industries with complete assistance for securing sub-contracts or contracts on war production orders."

Charles A. Collier, vice-president of the Georgia Power Company, said that "small Southern industries must be worked into the war production program if we are to avoid defeat in the war and defeat on the home front when the war is over."

Southeastern regional officials of the War Production Board and officials of the Georgia Power Company are seen, above, discussing plans for cataloging the industrial facilities and resources of Georgia in an effort to obtain more war contracts for Georgia industries. Seated, from left, the men are: W. H. Barnwell, industrial agent of the Georgia Power Company; Julian L. Mason, manager of production division of the WPB in Southeastern region, and Charles A. Collier, vice-president of the power company and vice-chairman of the Georgia Industrial Location Advisory Committee. In back row are three industrial specialists of the WPB in Southeast, Robert P. Sweeny, textiles; Fred E. Scott, foods, and Russell Garner, bedding.

---

86 New Members Enrolled in I.A.E.I.

Eighty-six new members have been enrolled in the Southern Section, International Association of Electrical Inspectors, since the annual meeting of the section last October, according to a report by C. M. Jones, secretary of the Southern section.

Members of the section who have enrolled members are listed below:

Bagwell, H. O., Carrollton, Ga.	1
Boger, C. A., Charotte, N. C.	1
Bommer, A. J., Dallas, Tex.	3
Bushnell, R. O., Miami, Fla.	2
Byrum, R. L., Greensboro, N. C.	1
Campbell, R. D., Asheville, N. C.	2
Camus, F. C., Shreveport, La.	3
Davis, James E., Galveston, Tex.	4
Eberling, J. H., Houston, Tex.	1
Edwards, Steve, Quincy, Fla.	1
Edwards, T. W., Jacksonville, Fla.	1
Fisher, Jack, Jackson, Miss.	8
Flynt, H. F., Winston-Salem, N. C.	1
Guess, Earle B., Jackson, Miss.	2
Hancock, A. E., Austin, Tex.	1
Harpster, R. L., West Palm Beach, Fla.	1
Hayes, Ray, Corpus Christi, Tex.	1
Hendricks, R. B., San Antonio, Tex.	1
Hobson, Luther, Sheffield, Ala.	1
Houston, O. A., Durham, N. C.	1
Hunter, Carl, Rusk, Tex.	3
Johnson, Dewey, Atlanta, Ga.	1
Jones, C. M., Atlanta, Ga.	1
Jones, Cecil T., Atlanta, Ga.	10
Julian, L. H., Salisbury, N. C.	1
Leeman, C. R., Houston, Tex.	2
McConnell, E. S.	2
Meullier, R. W., Ft. Lauderdale, Fla.	1
Miller, G. M., Richmond, Va.	3
Muths, S. L., Gulfport, Miss.	2
Noake, Harold, Corpus Christi, Tex.	1
Peoples, Troy, Roby, Tex.	1
Phillips, Earl, Clinton, Miss.	1
Peters, K. O., St. Petersburg, Fla.	1
Ricketts, G. B., Lockport, La.	1
Rousseau, G. C., Salisbury, N. C.	2
Sampson, T. W., Jr., Jackson, Miss.	1
Segall, B. Z., New Orleans, La.	2
Stall, W. A., Jacksonville, Fla.	1
Stanford, A. G., Atlanta, Ga.	1
Watkins, W. F., Atlanta, Ga.	1
Welman, Geo., New Orleans, La.	1
Whitaker, C. S., Durham, N. C.	5
Whiting, C. T.	1
Zimmer, Charles, Houston, Tex.	3

American Steel & Wire Wins Navy "E" Flag

In one of the most impressive and colorful occasions experienced in

The official party which participated in the presentation of the Navy "E" Award to the Electrical Cable Works, of American Steel & Wire Co., at Worcester, Mass. Left to right, in front row, are Rear Admiral Wat T. Cluverius, USN, Ret., and president of Worcester Polytechnic Institute; Capt. J. J. Hyland, of the Boston Naval Inspection Bureau; Capt. C. J. Wheeler, Commandant of Holy Cross Naval R.O.T.C.; and C. F. Hood, president of American Steel & Wire.

Worcester, Mass., in many years, the local plants of the American Steel & Wire Co., U. S. Steel subsidiary, recently were awarded the Navy "E" for excellence in production.

A crowd of 3,500 employees of the company filled Worcester Memorial Auditorium to watch Rear Admiral Wat T. Cluverius, U.S.N., Ret., present C. F. Hood, company president, with the Navy "E" burgee. The presentation was a climax to a day which had seen Navy representatives and company officials tour the Electrical Cable Works of American Steel & Wire Co., in Worcester.

Illuminating Engineers Will Meet in St. Louis

September 21st and 22nd are the dates set for the 1942 Illuminating Engineering Society Wartime Lighting Conference. St. Louis is to be host for this conference which will be devoted entirely to the discussion of the lighting problems now faced by our country at war.

Blackout lighting, lighting for wartime production and substitute materials as they affect the lighting industry are a few of the topics to be covered.

PERSONAL NOTES
About Men You Know

John E. Jackson, manager of the Lynchburg district of the Appalachian Electric Power Company, has been granted leave of absence to join the staff of the United States Office of Scientific Research and Development in Washington. Mr. Jackson's leave was requested by Dr. Vannevar Bush, director of the government agency.

G. Roberts Neubauer, assistant manager, will be in charge of the company's operations during Mr. Jackson's absence.

* * *

Bernal E. Clark, advertising and sales promotion manager of Florida Power and Light Company, has been commissioned first lieutenant in the Army Air Force and is temporarily stationed at Miami Beach, Florida. During the first World War, he served two years in the Army, going to France with the 35th Division, where he was a regimental observer on the front lines in two major offensives. After the war, he returned to college and graduated in 1921 from the University of California. He has been in newspaper work, as reporter and editor, and before joining the power company, in 1936, as advertising manager, he was an executive in the Miami advertising firm of Loomis, Bevis & Hall. Since coming to Miami in 1925, he has been prominently identified with civic enterprises in south Florida, and in 1941 served as president of the Miami Ad Club.

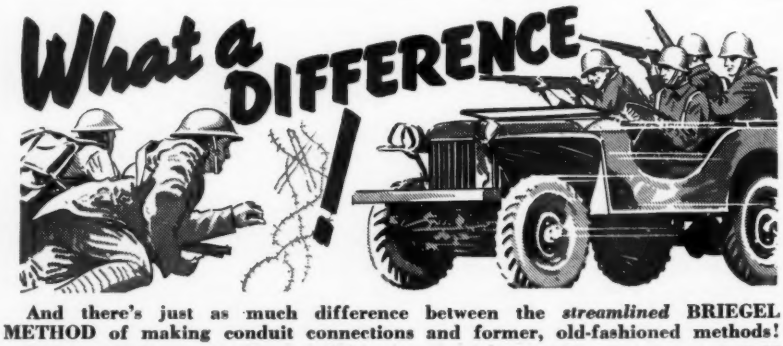
* * *

E. A. Gebhardt has just been elected president of Commercial Advertising Agency, Inc., of Chicago, Ill. Mr. Gebhardt entered the advertising field in 1906 as an art apprentice with Commercial's predecessor company. In addition to the training in industrial art, his experience covers many phases of advertising, such as mechanical production, sales promotion, merchandising and client service. For about eight years he has been quite active in the affairs of the Chicago Industrial Advertisers Association, as chairman of the various committees, then director and vice-president in charge of programs, at the same time serving on N.I.A.A. committtees. In 1940 he was a member of Industrial Marketing's Jury of Awards and just recently was appointed a Director of Chicago Central Lions Club.

E. A. Gebhardt

* * *

The Boston Woven Hose and Rubber Company announces that, effective July 1, 1942, **Gordon N. Lewis** joined their organization as sales manager of their tape department. Mr. Lewis is well and favorably known to members of the electrical industry and has for the past eight years been associated in a similar capacity with Jenkins Bros. Co., Bridgeport, Conn.



And there's just as much difference between the *streamlined* BRIEGEL METHOD of making conduit connections and former, old-fashioned methods!

Take a look at the picture below: two squeezes with the patented B-M "indenter" (which costs only $1.25) and you have a smooth, efficient job when you use B-M connectors and couplings. No extra turns or twists—no nuts to tighten!

The BRIEGEL METHOD saves you up to 50% on time and a substantial materials-saving (in keeping with today's thinking). Means more profit, too! Approved by Underwriters' Laboratory, of course.

DISTRIBUTED BY

The M. B. Austin Co.
Chicago, Ill.
Clayton Mark & Co.
Evanston, Ill.
Clifton Conduit Co.
Jersey City, N. J.
General Electric Co.
Bridgeport, Conn.
The Steelduct Co.
Youngstown, Ohio
Enameled Metals
Pittsburgh, Pa.
National Enameling & Mfg. Co.
Pittsburgh, Pa.
Triangle Conduit & Cable Co.
Elmhurst, N. Y. C.

BRIEGEL METHOD TOOL CO., Galva, Ill.

S. H. Mortensen, engineer-in-charge of a-c design for 10 years, has been appointed chief electrical engineer of the Allis-Chalmers Mfg. Co., plants at West Allis, Cincinnati, Boston and Pittsburgh.

Starting at the Allis-Chalmers Norwood works in 1905, Mr. Mortensen transferred to Milwaukee as an electrical draftsman three years later. There he successively became design engineer for d-c machines, design engineer of rotating synchronous machines, and in 1932 engineer-in-charge of alternating current design.

S. H. Mortensen

Mr. Mortensen was born in Denmark, studying in Europe before coming to America. He has been responsible for pioneer work in the development of self-starting synchronous motors, synchronous condensers and turbo-generators. In addition to contributing numerous articles and papers on electrical operation and design to the leading professional papers, he has been the author of a textbook on Motor and Generator Design, and more recently, a co-author of the Standard Handbook for Electrical Engineers.

He is a fellow of the AIEE, a member and former director of Engineers Society of Milwaukee, and the Allis-Chalmers representative for the Edison Electrical Institute.

* * *

Three major shifts of Virginia Public Service Company executive personnel were announced recently by **W. E. Wood,** president. These changes were occasioned by the resignation of **F. A. Mitchell** as vice-president of the company with headquarters in Newport News. Mr. Mitchell resigned to become president of the Newport News Distilled Ice Co.

J. W. Howard, manager of the Northern Division, serving Alexandria, Leesburg, Warrenton and other communities, was elected vice-president and manager of the Eastern Division. The Eastern Division covers the Peninsula area in and adjacent to Newport News, where the Virginia Public Service Company operates gas, electric and transportation systems.

G. E. Kidd, manager of the Eastern Division, is to assume Mr. Howard's former duties as manager of the Northern Division, and, in addition, he will have supervision over the company's service in Arlington County which formerly was under the direction of **B. J. Dorsey.** Mr. Dorsey will move to Newport News as assistant to Mr. Howard.

* * *

Thomas J. Fleischer, vice-president of Walker Electric Company, of Atlanta, manufacturers of metal boxes and other electrical products, has been appointed a member of one of the industry committees of the War Production Board. The committee upon which he will serve is known as the enclosed box group.

* * *

George W. Hart, sales consultant for Ebasco Services, Inc., since 1936, has resigned to join the Government Contract Service staff of the Radio Division of Western Electric Company, Inc., at 120 Broadway, New York City. Mr. Hart graduated in electrical engineering from Bucknell University in 1927. After several years in electrical work for Bethlehem Steel Company and the Pennsylvania Railroad he began his electric utility connections as commercial engineer with New York and Queens Electric Light and Power Company. Graduate study in public utility economies, at New York University, led to his subsequent position with Ebasco Services, the consulting and advisory service organization for the Electric Bond and Share System.

For the past two years Mr. Hart has been chairman of Edison Electric Institute's Wiring Committee, and a member of the Planning Committee of the National Adequate Wiring Bureau.

* * *

Charles Spooner Zimmer, of Houston, Texas, long associated with the Busman Fuse Company, died at his home Tuesday, July 21. Mr. Zimmer, who was 52 at the time of his death, was chairman of the Membership Committee of the Southern Section, International Association of Electrical Inspectors and has been most active in the affairs of the Association. He was a member of the Rotary Club, B.P.O.E., A.I.E.E., and the Houston Engineers Club.

* * *

Flavius J. Hendley, superintendent of overhead lines for the Chattanooga Electric Power Board, died in a Chattanooga hospital on June 21, following a brief illness. Mr. Hendley, who was 40 years of age at the time of his death, studied engineeering at Alabama Polytechnic Institute at Auburn. Following his graduation he was employed by the Alabama Power Company.

He was also employed for a time by Allied Engineers and by the Georgia Power Company. He moved to Chattanooga some twelve years ago to work for the Tennessee Electric Power Company, and after the power company was taken over by the Chattanooga Electric Power Board, he was retained in his same capacity.

Today they're COOKING UP TROUBLE for the AXIS

CHROMALOX
ELECTRIC UNITS

in various forms suitable for industrial use are putting the heat on Hitler and the rest of the Axis gang in war production plants everywhere. Meanwhile Chromalox range units in thousands of homes may be confidently expected to hold the fort "for the duration."

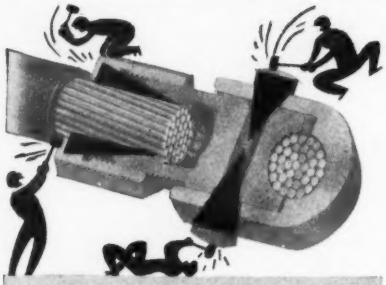
We shall continue to do our utmost to take care of your service requirements on Chromalox electric range units.

ATLANTA, Ga.—C. B. Rogers, 1000 Peachtree St. DALLAS, Texas—L. R. Ward, 403 Southland Building Annex. RALEIGH, N. C.—W. R. Phillips.

EDWIN L. WIEGAND COMPANY, 7600 THOMAS BLVD., PITTSBURGH, PA.

Did You Know

since time immemorial, the wedge has been the orthodox method of tightening and permanently joining two bodies together?



"Gorilla Grip" mechanical connectors use two types of this wedging principle.

The long-bodied, fine-threaded nut (c), the soft copper serrated sleeve (a), and the hard brass lockring (b) tapered with the same taper as the nut are used in what is known as the Terminal Unit of the Connectors.

This Terminal Unit is machined to snug and compact the wires and cables as the nut is tightened on the thread of the body. This wedging action makes a mechanically as well as electrically perfect connection.

The tapered head bolt (d) and nut (e) on the yoke and body of the fittings draws these two members over the cable providing perfect electrical contact. Pressure is uniformly distributed over the full contact area and simultaneously locks the parts into position.

Write for our booklet which illustrates these mechanical principles in more detail.

National Electric
PRODUCTS CORPORATION
300 FULTON BUILDING, PITTSBURGH, PA.

NEW EQUIPMENT and MATERIALS

New Thin Slot Insulations

New thin types of Irv-O-Slot insulation described below have been developed by Irvington Varnish & Insulator Company, Irvington, N. J., to provide non-bulking slot insulation for use in confined or limited space: resin coated fish paper, resin coated Spauldo paper, varnished silk duplexed to fish paper, special thin varnished cambric duplexed to fish paper duplexed to Spauldo paper, and varnished Fiberglas duplexed to fish paper duplexed to Spauldo paper.

These materials plus straight-cut and bias-cut varnished cambric in heavier combinations provide for every slot requirement.

Irv-O-Slot insulation consists of fish or Spauldo papers coated with resin, or bonded by means of a plastic insulator to cambric, silk or Fiberglas. According to the manufacturer, these insulations possess ample strength and toughness as protection against mechanical stresses and have high dielectric strength. The duplexed Irv-O-Slot and Spauldo paper have exceptional heat resistance. The bonded insulations have high moisture resistance. All of these insulations are flexible and easy to form which simplifies and speeds application. It is available in sheets and also tape form ready to be cut into slot strips.

Regulation Calculator

For designing new electrical layouts or putting in new power lines needed in industry for war production, engineers are using a handy transformer regulation slide rule to quickly calculate the per cent regulation of the electrical equipment involved. The calculator is being distributed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Although designed primarily for calculating transformer regulation, the slide rule can also be used for calculating the regulation of other electrical apparatus. It indicates reasonably accurate per cent regulation for a given resistance and reactance with one quick setting. The slide rule takes the place of the customary method of substituting in formulas or nomograms in which a straight edge is required to read the diagram.

Copies of the calculator can be obtained from the Allis-Chalmers Mfg. Co. by requesting Form 3019.

Cold-Cathode Fluorescent

The advantages of cold-cathode fluorescent lighting, particularly as applied to wartime industries, are dealt with in an 8-page folder just issued by the Fluorescent Lighting Association, 509 Fifth Ave., New York City.

This type of lighting, which can be effectively installed without reflectors or fixtures, is filling a real need.

The folder also deals with recent standardization of equipment and installation practice by means of nation-wide certification of approved products and of local lighting contractors. A copy of the folder is available on request to the Association.

Keeping pace with UNCLE SAM

You can't go *"all-out"* when you're *"all-in"*...the air-conditioned, noise-proofed rooms and inner-spring mattresses at Hotel Mayfair renew your energy.

hotel Mayfair
St. Louis
COMPLETELY AIR-CONDITIONED
RATES FROM $3.25

Wiremold No. 3000 Raceway

Newly developed fittings and installation methods make possible an entirely new and simplified "network" type of electric wiring installation utilizing basic Wiremold No. 3000 raceway and taking off with other Wiremold raceways to provide complete surface wiring layout for lighting and portable tool or appliance power outlets in production areas, engineering departments, laboratories and plant office buildings.

Rigidity of Wiremold No. 3000 Channel and special Wiremold hanger fittings permit spanning of beams. Minimum number of Wiremold "slip joint" fittings cover all installation methods and requirements. Simplified layouts use minimum of steel and other scarce materials. Wiremold installation methods require no pipe threading equipment, climinate messes and inconvenience, and reduce material waste. Standardized sections and parts quickly installed, using only hack saw, screw drivers, pliers.

Installations for fluorescent lighting of working areas can be completed using same basic Wiremold No. 3000 Channel with reflectors, ornamental glass enclosures, hangers and fittings for both unit type or continuous Line-O-Lamps fluorescent fixtures. Detailed bulletins and catalogs available on request from The Wiremold Company, Hartford, Connecticut.

Wiring Tools

The Greenlee Tool Co., Rockford, Ill., offers a 48-page catalog of Greenlee Tools for bending conduit and tubing, pushing pipe underground, pulling in cable, punching holes in steel cabinets and panels, boring holes in wood, and various other operations required in electrical installation work. Copies of the catalog are available upon request.

Autovent Blower Catalog

A new 76-page catalog, Number 303, describing Autovent Type H and Type HB centrifugal blowers has just been released by Autovent Fan and Blower Division, The Herman Nelson Corporation, Chicago, Illinois.

The catalog is divided into two sections: Part I is an attractive 20-page bulletin printed in two colors and profusely illustrated with photographs of the blowers showing various drive arrangements and discharges, in both single inlet, single width and in double inlet, double width construction. The text explains construction features, bearings and performance characteristics of the Autovent Type H Blower, incorporating the forwardly curved blade wheel, and of the Autovent Type HB Blower, incorporating the backwardly curved blade (non-overloading type) wheel. Application of both types in heating, ventilating and air conditioning systems is described.

Part II of Catalog 303 consists of 40 pages of engineering data and capacity tables covering performances of Autovent Type H and Type HB Blowers at static pressures from ⅛" to 5". In addition, 16 pages are devoted to dimension drawings illustrating 78 different views. Complete dimension data is furnished for all 17 sizes of these blowers.

Goodrich Rubber Gloves

A four-page catalog section on electricians' gloves, made by the Anode process from liquid latex, has just been published by The B. F. Goodrich Company, of Akron, Ohio, and is now available upon request.

The catalog section describes the manufacturing process and its advantages, illustrates the types of gloves the company makes, and the rigid tests which have to be passed before the gloves are certified for use.

Q-Floor Wiring Catalog

A new 24-page catalog on General Electric wiring for underfloor electrical distribution in H. H. Robertson cellular steel Q-Floors has been announced by the conduit products sales section of General Electric Company's appliance and merchandise department, Bridgeport, Conn. Fittings and accessories, illustrated and described in the catalog, provide for the use of the hollow cells of Q-Floors as raceways for wiring, thus making virtually the entire floor available for electrical services. Six basic types of Q-Floors are described.

Dry Type Transformers

R. E. Uptegraff Manufacturing Company, Scottdale, Pa., has issued a new 16-page catalog, Bulletin No. 113, on "Dry Type Transformers." Illustrated are both Type E and Type DA Uptegraff transformers and drawings, and also reproduced are photographs of the Uptegraff plant and organization. A copy of this new Bulletin No. 113 may be had by addressing R. E. Uptegraff Manufacturing Company, 104 Transformer Road, Scottdale, Pa.

"FLURATEX" REFLECTOR UNITS

Curtis lines up with the nation's conservation program by offering its Non-Metallic Reflector Industrial Units with a minimum amount of steel.

Cat. No. 1506 is designed for two 40 watt fluorescent lamps with provisions for the installation of a third lamp at any time. Cat. No. 1507 for three 40 watt lamps. Cat. No. 1508 for two 100 watt lamps.

The "Fluratex" reflectors on these units are guaranteed to give first-class performance. They are rigid in construction, chip-proof and designed to utilize all the light from the lamp.

"Fluratex" reflectors are finished in Fluracite, a baked synthetic reflecting surface, glossy white and mineral hard, discovered by Curtis after extensive research, especially developed to maintain and not distort the color value of the fluorescent lamp. Fluracite possesses unusually high reflectivity and is easily cleaned with soap and water. Fluracite has been successfully used for over 3½ years on most Curtis Fluorescent products.

Write today for further information.

Representatives for Southern areas

R. S. CALHOUN, P. O. Box 1164, Atlanta, Ga.

T. H. BAILEY, JR., 614 Garrett Bldg., Baltimore, Md.

HUIE-SIMMER CO., 103 Thomas Bldg., Dallas, Texas

GEORGE C. LAW, 915 Olive Street, St. Louis, Mo.

J. W. MORRISON, 416-18 Keith Bldg., Cincinnati, Ohio

CURTIS LIGHTING, INC.

6135 W. 65th Street . . Chicago

AVAILABLE NOW

Conserve Critical Materials!

"Wire-Nuts" save critical war materials — Lead, Tin and Rubber as used in solder-and-tape joints.

Wire-Nuts

Solderless, Tapeless Wire Connectors

Millions In Use—Better electrically; stronger mechanically. Ask for free samples.

FULLY APPROVED. Listed by Underwriters' Laboratories, Inc. SIZES FOR EVERY JOB.

Other War-Time Wiring-Job Speeders

IDEAL SOLD THROUGH JOBBERS

IDEAL COMMUTATOR DRESSER COMPANY
1017 Park Avenue Sycamore, Illinois

Fibre Insulation

The Wilmington Fibre Specialty Company, Wilmington, Del., has just issued a leaflet entitled "Keep Machines Moving." The leaflet suggests the advantage of carrying a small stock of vulcanized fibre for maintenance requirements. It reports that many companies are finding a small stock of vulcanized fibre a big help in making repairs to electrical apparatus, welding apparatus and the like. The Wilmington Fibre Specialty Company offers a wide range of vulcanized fibre sheets, rods and tubes. This material has many applications as, for example, shims on motor spacers, coil tamping tools, etc.

Appliance Dealers Meeting Emergency

(*Continued from page 33*)

a line of garden tools and accessories, and he has various types of vitamin mixtures for plants, soil improvers, fertilizer and the other kindred items for the city gardener. This dealer expects to have a large stock of seeds, bulbs, plants, etc., for the fall garden season.

Mr. Duffie says that gardening is the nation's most popular hobby now. People are growing vegetables for patriotic reasons, and they are growing more flowers and taking more interest in their homes because of the tire and gasoline rationing, war bond buying, etc. He believes the garden department will carry the overhead of his main store and help him stay in business and retain his identity in the electrical appliance business. He is expanding his service sales at the second store, handling all electrical service from that location.

Promoting Your Service Sales

(*Continued from page 26*)

successful methods and apply them to your service business. The framework for getting the job done already exists because you and your organization know the methods. Now it's a case of transferring the application from merchandise sales to repair sales.

Keeping your business going from now on requires active promotion to realize sufficient volume to keep your costs in line. And every effort you put out will make your position stronger for the day when peace comes and civilian goods production is resumed again.

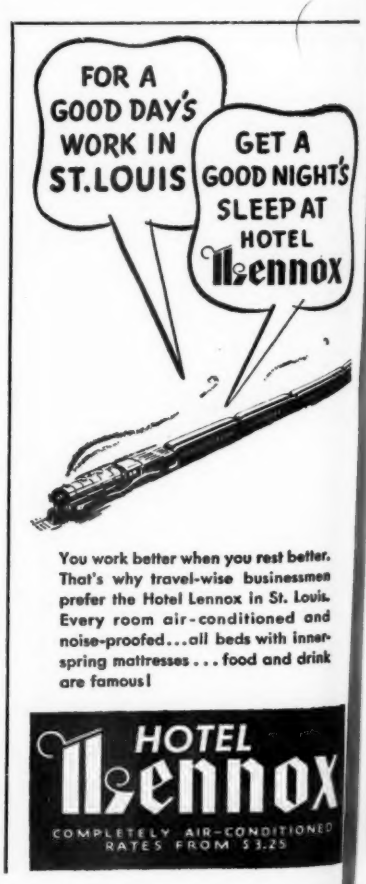
Eliminating Industrial Machine "Camouflage"

(*Continued from page 18*)

inged areas give greater light diffusion when flat or egg-shell finish is applied. But when factory ceilings are excessively high, a gloss white may be the best solution, particularly when such factors as dirt resistance and washability must be considered. For these qualities, a glossy finish will give the best performance."

The whole research project proved that three-dimensional seeing through the right combination of color and light greatly improve plant conditions.

By showing the du Pont movie on the Science of Three-Dimensional Seeing, by distributing the booklet quoted above on the subject, and by giving free demonstrations of the difference three-dimensional painting of a machine makes, lighting engineers in Georgia and elsewhere in the south have influenced industrial plants and machine shops into painting their machinery and shops to obtain the welcome advantages of



You work better when you rest better. That's why travel-wise businessmen prefer the Hotel Lennox in St. Louis. Every room air-conditioned and noise-proofed...all beds with inner-spring mattresses... food and drink are famous!

HOTEL Lennox

COMPLETELY AIR-CONDITIONED
RATES FROM $3.25

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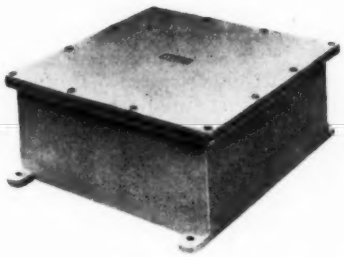

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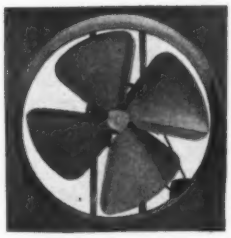

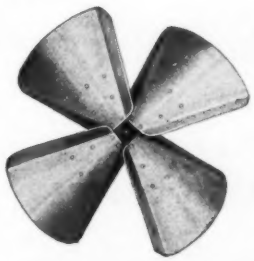

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Maintenance Practice For Welding Apparatus

(*Continued from page 9*)

anently installed on inlet and exhaust air openings, resulting in severe overheating and very short equipment life.

Improper connection of extension leads for either the electrode or work terminals is not at all uncommon. This results in a high resistance circuit from welder to arc and return with resulting variations in welding current, particularly when the leads are moved so as to change the resistance of the connections. This is a frequent cause of complaints by welding operators that the heat is not steady.

The remedy for this is to make sure that connections are kept tight, and that all connections are made with cables equipped with properly installed cable lugs or terminals. It is practically impossible to bolt or wedge untinned flexible cable to another conductor and secure a good low-resistance joint. Soldered or reliable solderless connectors or terminals should always be used.

The use of excessively long electrode or work leads with motor-generator type welders will result in overheating of the motor when operating in the upper part of the current range unless extraordinarily large cables, or a number connected in parallel, are used. Overheating of the motor from this cause is a frequent reason for motor-generator welders tripping off the line with consequent loss of production.

A source of trouble which is not protected against by the motor overload relays is the intentional or unintentional application of long continued short circuits on the generator. Poor cable or cable connection insulation may be responsible for unintentionally short circuiting a generator for long periods of time. This results in the flow of very heavy generator current, but because of the low generator voltage involved, does not require sufficient power input from the line to cause the motor overload relay to trip.

While the motor is not damaged, the generator may be seriously overheated or burned out. The same results will follow intentional permanent short circuiting of the electrode holder on the work or any grounded conductors.

The use of improperly bonded structural steel systems or building frameworks for the welding current return circuit is undesirable. The high resistance path thus afforded the welding current may result in overheating of the welder motor, and in addition, there is always the possibility that arcing or overheating of some poor connection, possibly quite remote from the scene of operations, may go unnoticed and start a fire.

No attempt should be made to adjust welding current output by any means other than those provided and recommended by the manufacturer of the equipment. Shifting the brushes on generators not designed for brush-shifting control will usually result in inferior welding characteristics, impaired commutation, and short brush life. Short circuiting of resistors or rheostats or any other tampering with the control furnished on arc welding equipment may result in damaging or burning out of the equipment.

In transporting welding equipment, rough handling resulting in permanent mechanical damage is all too frequent. Motor-generator sets mounted on steel wheeled running gear should be moved only at slow speeds—never behind fast-moving trucks or other vehicles. They should be eased over obstacles and depressions such as flange clearance grooves in tracks. Slings used for transportation of welders by crane should be carefully arranged to avoid damaging control boxes, handles, and other equipment mounted on the outside of the set.

Care should be taken to avoid using arc welders out-of-doors in unfavorable weather. Many machines now on the market are designed to be both semi-protected and dripproof. This does not mean, however, that these welders should be used in rain or other precipitation without suitable protection.

At the discretion of the user, of course, dripproof or even open motor-generator sets can be operated out-of-doors, provided they are protected from obviously damaging conditions by tarpaulins or temporary shelters. These may be arranged so as not to hinder ventilation of the equipment, as previously discussed.

In spite of the reliability of the modern arc welder, troubles will occur. The causes and remedies for the majority of such troubles are given in the tabulation on pages 8 and 9.

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115. FLUORESCENT LIGHTING ACCESSORIES—Fall Bulletin No. 3, describing and illustrating complete Lloyd line of Fluorescent Lamp Holders, Starters, Starter Sockets and Holder and Socket combinations. Lloyd Products Company, Providence, R. I.

117. MECHANICAL CONNECTORS—First Aid for electrical systems through the use of mechanical connectors is the subject of an interesting twenty-page booklet now available. In addition to specific construction and sales of the new "Gorilla Grip," this booklet describes a wide range of mechanical connectors for every size and purpose. National Electric Products Corp., Pittsburgh, Pa.

120. SQUARE D COMPANY announces the Spring issue of the Square D Digest, dated April, 1941. This condensed catalog contains listings and the latest prices of many Square D products, including Safety Switches, Service Equipment, Multi-breakers and other Circuit Breakers, Panelboards, Motor Control and Pressure Switches. Square D Company, Detroit, Michigan.

129. BULLETIN 403 on BullDog enclosed bus bar system of electrical distribution for commercial and industrial use. Forty-four pages of construction details, applications, dimensional data and technical charts. BullDog Electric Products Company, 7610 Jos. Campau Avenue, Detroit, Michigan.

132. INDUSTRIAL WIRING HANDBOOK: This 48-page handbook, called "Adequate Wiring for Industry," describes modern factory wiring methods and materials. Wiring practices adaptable to all factories are outlined. Publ. No. 51-4011. General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.

142. ELECTRICAL CONDUIT — Complete technical information on corrosion-resisting asbestos-cement ducts for underground and overhead service, with and without concrete envelop, is included in "Transite Conduit and Korduct for the Electrical Industry," DS Series 410. Johns-Manville, 22 East 40th Street, New York, N. Y.

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168. GREENLEE TOOL CATALOG NO. 33-E — a 48-page catalog of GREENLEE TOOLS for bending conduit and tubing, pushing pipe underground, pulling in cable, punching holes in steel cabinets and panels, boring holes in wood and doing various other operations. Greenlee Tool Co., 1766 Columbia Ave., Rockford, Ill.

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